WORK

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WORK WORLD.

WOMEN are employed in fishing tackle manufacture to make the flies, and although some branches of this industry are overstocked, it is stated that women able to tie a fly fit to captivate a trout or salmon can earn £3 to £4 a week. This branch of women's work, then, is not underpaid!

* *

At the South London School of Technical Art, the students for wood engraving have for some reason fallen off, although the occupation offers exceptional advantages to women, the highest rate of remuneration for this class of work being about £3 a week. Why is this?

* *

An ingenious Belgian has patented a simple arrangement by which two blocks of cork can be securely clamped into an ordinary horse-shoe. The cork, it is stated, lasts as long as the shoe itself, and renders slipping on greasy or frosty pavements impossible. The L. G. O. Co. should be here.

* *

A new primary electric battery has been made in which carbon derived from small coal is used instead of zinc; the other element is a preparation of nitrate of potash. If this is found reliable in practice, it will overcome the great objection—expense of working—where zinc is consumed.

* *

Delta metal appears to be growing in favour. It has been before the public now about five years. It possesses the great advantage of being readily cast, forged, or stamped; and of being scarcely affected by sea water. It is now coming into general use. Five launches have been built completely of this alloy, and it has been used for casting several screw propellers for large steamers.

* *

A new and useful departure in the direction of hot-water apparatus work is met with in some new coils, or radiators, which, being cast in one piece, save a vast amount of trouble in making, and avoid the chance of leaky joints after being fixed. The coils can be made in sections, and any number of them joined in length or grouped together as desired. Altogether, the invention is a good one, and seems to mark a definite advance in heating by hot-water pipes.

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Over two hundred regular sea-going steamers are laid up on the Tyne alone through the coal miners' strike, and shipowners are attempting to take advantage of the scare, to reduce the wages of seamen and firemen in their employ. This is, however, strongly resisted by the Seamen's and Firemen's Union. Another standing inconvenience from the same cause is the withdrawal of part of the North Eastern Railway Company's passenger train service.

* *

Petroleum is being used as fuel on the Argentine Great Western, and it will probably supersede all other fuel on that road. The oil used is a heavy petroleum found at Mendoza, near the line of the road, which answers the purpose of fuel fairly well, although it has been found impossible to refine it so as to make a good lamp oil. The economy is very considerable, as the railroad company can procure this oil at present at a cost of 12 dols. paper per ton—equivalent to about 3 dols. gold—while English coal, which has been used on parts of the line, costs 20 dols. gold per ton.

* *

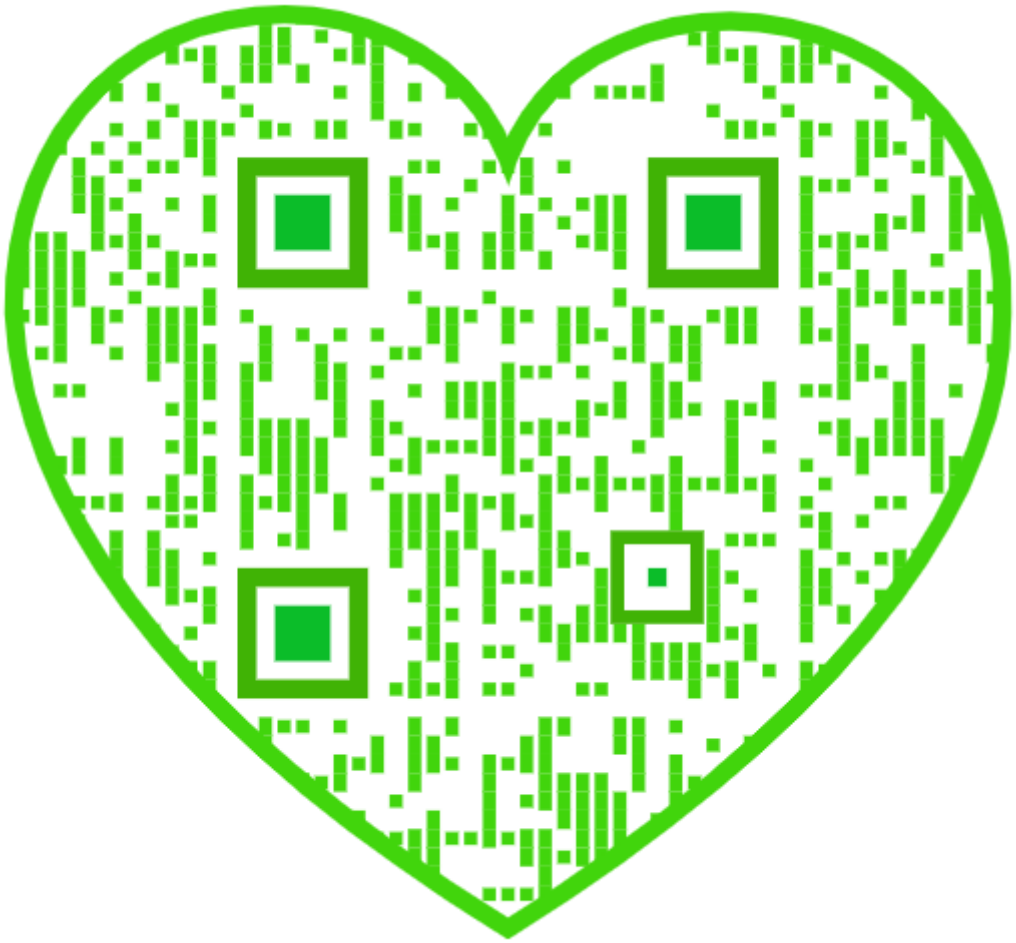
Finely divided aluminium has previously been suggested as a substitute for magnesium as an actinic light for photographic purposes. Now that it is cheaper than magnesium, the following formula for a mixture, which is recommended by a French contemporary as giving a powerful flash, may be of use to those of our readers who are interested in photography:—100 parts aluminium powder, 25 parts lycopodium, 5 parts ammonium nitrate. This powder can be used for flashing in an ordinary spirit lamp, but gives a brighter and more powerful light if the powder be flashed into the flame by means of a jet of oxygen gas.

* *

A patent has been granted for a method of solidifying steel ingots. The process consists in pouring molten steel slag on the molten steel immediately after the latter has been poured into the mould, and before it has had time to set. The steel castings thus treated are dense and homogeneous, and free from pipes and blow-holes. The process is adapted to the pouring of all classes of steel ingots, but has been used mainly in the production of annular ingots for tire blooms, to be rolled into tires by a patent process. A tire ingot 10 in. high, on which 2 in. of slag has been run, falls 2½ in. in the centre, which shows how much the ingot condenses. It is noticed that the slag continues liquid after the steel has set. The slag is easily removed afterwards, as it has no tendency to unite with the steel. Not more than one-half as much metal is required to be sheared off the top of ingots treated in this way as compared with those poured without the slag covering.

* *

Anyone who has attempted to cut a curve in a sheet of metal with a pair of tinsmith's shears—or even in cardboard with ordinary scissors—must be aware of the great difficulty of the operation; how the sheet twists and twirls, bends and hangs on to the shears, greatly increasing the power that has to be expended, while it is absolutely necessary to begin the cut from the edge of the sheet. Prompted, no doubt, by the bevelled discs used in machines for cutting out the bottoms of pots and pans from block tin, a M. Lachaume has lately adapted the system to a pair of hand shears, which have the advantage of making a cut without necessarily beginning at the edge, provided only that a sufficiently large incision be made in the sheet to enter one jaw of the shears, which may also be held either above or below the metal to be operated upon. Each jaw of the new tool is fitted with a bevelled disc of hardened steel, ground to an edge, sharp, without presenting an acute angle to the work, and, of course, with the cutting edges in contact. The handles are kept apart at their greatest extent by a spring, as in what the French call a *sécateur*, or pruning shears. On their being brought together by the hand of the operator in the action of cutting, they put in motion a lever which, engaging in the teeth of a ratchet wheel fast on the axis of one cutting disc, causes the latter to revolve and cut the metal, the other disc simply revolving through friction. It is stated that the Lachaume shears will cut sheet iron up to ¾ mm. thick, zinc and brass up to 1 mm., and cardboard up to 4 mm., the greatest thickness ever required in practice. The invention should prove valuable in a variety of trades.



In ladies' and gentlemen's button boots, it is found, after they have been worn a little time, that the front seam on each foot will run away to the inside. Now it is usual, in this class of work, to stay the outside quarter to the inside one by felling it to the lining at the edge of the fly-lining, so that in lasting there is no strain upon the button-holes. The advantage of this, however, does not counterbalance the evil of the seam running on one side, for this it is which is the cause of the above-mentioned fault. When the stretch is taken out of the quarters only, as a natural consequence, the fly stretches in wear, and throws the seam out of its proper centre.

* *

Sir William Gordon-Cumming, Bart., is about to have extensive alterations made in the houses of his estates in Morayshire. About £12,000 or £13,000 will be spent on Altyre House alone. Local labour will be employed, which will be a great benefit to the building trades in the North, where things have been rather quiet for a long time. Gordonstown, also, is to be modernised and added to.

A CHAT ABOUT CHAIRS.

BY F. JERMAN.

INTRODUCTION — RATIONAL DINING-ROOM CHAIR—LIBRARY OR STUDY CHAIR—FIXED SEATS FOR BARS AND RAILWAY CARRIAGES — CURVED BACKS — HALL CHAIRS—DRAUGHT FLAPS AND ARMS—DECORATION—COMMON FAULTS IN ORNAMENT—CONCLUSION.

IN making any kind of chair or seat the human figure should be considered, and the resting surface should be modelled so as to fit the average body properly. The first object of a chair is use, and it ought not to be regarded merely as a vehicle for ornament. We often see grave errors committed with regard to the form of chairs. The back and seat are sometimes made straight, and at right angles to one another. In consequence of this absurd form, no one can obtain comfort from them except by the employment of cushions, etc., and even then the fault is rectified only in a small degree. A common wooden chair, designed so as to fit the human frame properly, is more healthy and comfortable than a straight-backed chair, although the latter may be made endurable by using cushions and padding.

Fig. 1 is a section of a rational dining-room chair. The total width of the seat is 15 in. Beginning from the front, the edge of which is rounded, the seat is level for 1½ in., then it falls 1 in. or 1¼ in. in 9½ in., and for the remaining 4 in. it rises half an inch. This outline will be found very comfortable in comparison to the ordinary flat seat. The height from floor to upper surface of seat at the back is 16½ in.; from thence the back rises perpendicularly for 4½ in., and in the remaining 12 in. it slopes backward at the rate of 1 in. in 4 in. If cushions are intended to be placed on the seat, the latter should be made 1 in. lower, and 1 in. added to the upright portion of the back, making it 5½ in. This upright part gives support to the frame of the loins, and the slope above it helps the natural movement of the respiratory organs. The rail between the perpendicular and sloping part is very important, as, if placed where shown, help is given to the small of the back. The total height of the chair is 2 ft. 9 in. The top of the rail being placed at this height gives support underneath the shoulder-blades, which is the weakest part of the back.

Fig. 2 shows the same principle applied to a library or study chair. The 1½ in. piece in the front is omitted, and the seat is formed of two pieces of 10 in. and 4½ in. wide, with a hollow ¾ in. deep. The back rises from the seat perpendicularly for 4 in., and from thence slopes back 1 in. in 5 in. The hollow in the seat is not required so deep as in a dining- or drawing-room chair. By making the hollow of the seat rather slight, and raising the hind legs, greater facility is given for writing purposes or for use at study; and by shortening the hind legs, sloping the back, and sinking the rear part of the seat more, the chair will become suitable for repose. In benches for theatres, schools, and public halls, the dimensions in the section (Fig. 2) will be found to be convenient in most cases, but they can be altered to suit existing circumstances.

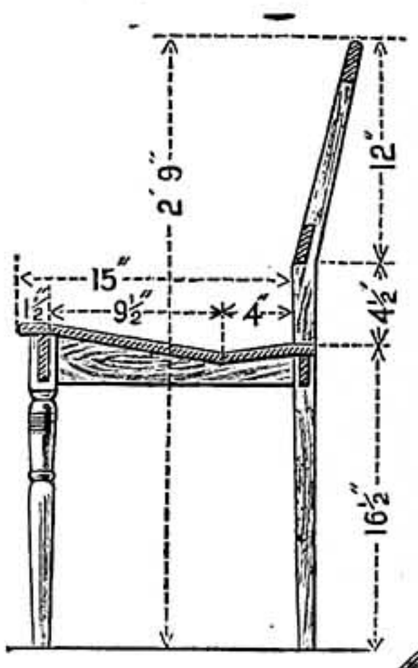


Fig 1.

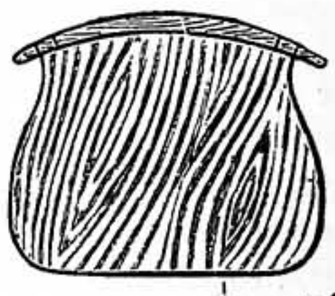


Fig. 4.

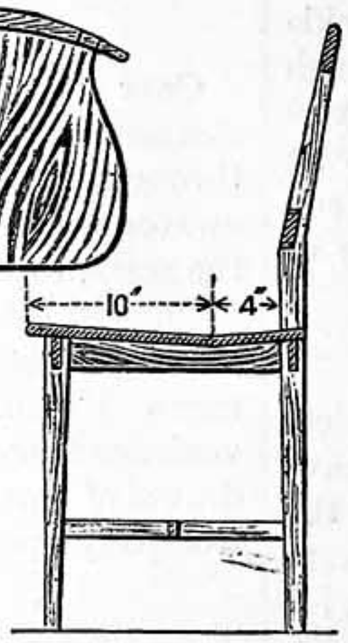


Fig. 2.

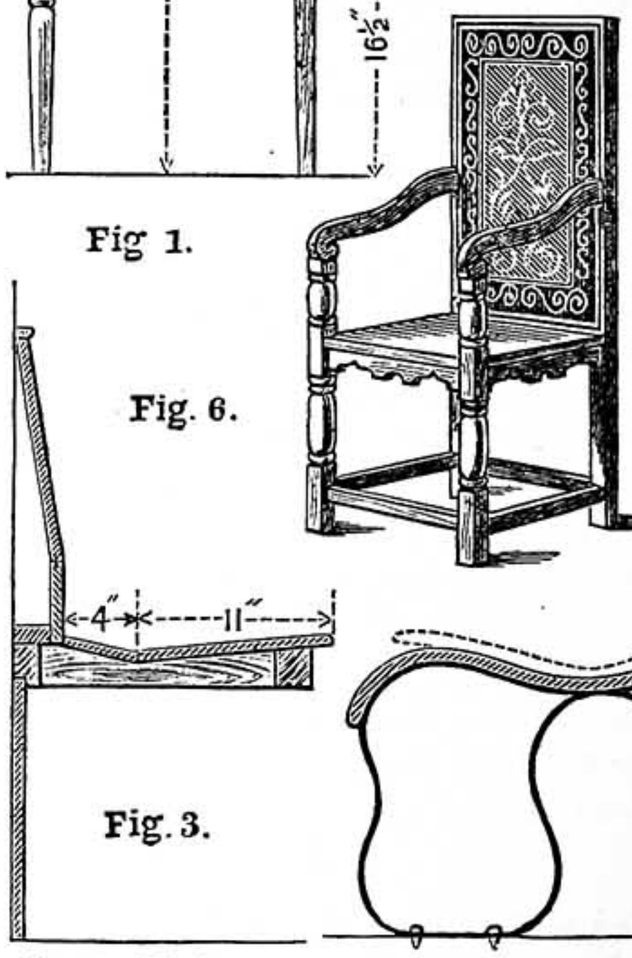


Fig. 6.

Fig. 3.

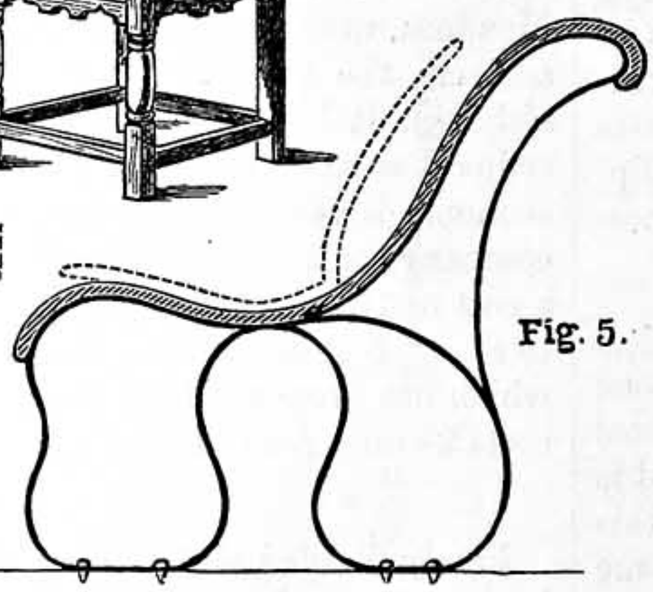


Fig. 5.

Fig. 1.—Dining-room Chair. Fig. 2.—Study Chair. Fig. 3.—Fixed Seat against Wall. Fig. 4.—Plan of Seat with Curved Back. Fig. 5.—Garden or Park Chair. Fig. 6.—Hall Chair.

For seats in bars and restaurants or railway carriages, or any place where they may be fixed against a wall, the section in Fig. 3 is recommended. The slope of the back is not so great as in the former sections. The seat is constructed of pieces of 4 in. and 11 in. wide, with a hollow between of 1 in.

Fig. 4 is the plan of a curved backed chair. A little reflection will convince the reader that this, as a rest for the back, is not a healthy form, as it tends to contract the chest and push forward the shoulders—which latter ought, of course, to be kept back in order to expand the chest and give room for the action of the lungs. A flat-backed chair will be found to do this much better than any other outline can. Unfortunately, these curved backs can be seen in almost every house, in the best furniture of the past century and this. Money is thrown away on ugly curved pieces, which are neither useful nor ornamental. Some old chairs, in which the plan of the back forms a semicircle, have even a more unhealthy tendency than the example shown here.

Fig. 5 is a sketch of a garden or park chair, consisting of a light iron frame with rounded battens forming the seat. At first sight the latter appears to be very inviting and comfortable, but when tried and analysed many faults will be found in it. It has too great an inclination backwards, and the curve at the back of the seat is too large. The curved part at the top is of no use whatever, neither is that at the front part of the seat. The seat is much too wide, and the curve in it is not correct. The dotted lines show the seat remodelled to fit the body properly. The perpendicular part of the back, which should never be absent in a chair, is shown here, and the other faults are rectified.

This kind of seat is the very opposite to a typical hall chair, shown in Fig. 6. The latter has straight lines and right angles throughout, while the garden seat is formed wholly of curves. However, it is difficult to determine which is the most unhealthy. The defects in the hall chair may perhaps be pardoned, as the seat is only intended for the temporary accommodation of visitors; but in the garden chair, where whole hours may be whiled away, it should certainly have not the mere semblance of comfort, but be designed for rest and ease.

It will be seen that the hall chair in Fig. 6 has a very high carved back. This is a favourite feature in old oak chairs. Some have a flap on each side, hinged to the back, to close against the arm in order to keep out the draught. These chairs came into general use in the thirteenth century. As the halls in buildings of that period were spacious, and gave free access to the wind, the high backs and draught flaps were very useful, and gradually became ornamental features. It may be remarked that the arms in Fig. 5 are much too high—another defect in the old chairs we should not imitate: 7 in. or 7½ in. from the seat to the top of the arm will not be found too low. If placed at 9 in. or 10 in., as is sometimes done, they will not rest the forearm in a natural position, but help to produce round shoulders and other unnatural habits of body.

A few words may be said about ornament; but, of course, this is a mere secondary consideration. A natural form is the first thing to be desired. When this is obtained, we may round off the angular parts and clothe it in a tasteful exterior—just the same as the bony frame of man has a covering of flesh and skin. In the same way we may hide the construction of a chair, but we ought still to feel that it is present, and that the chair is designed on proper principles, by the comfort obtained from using the seat.

Carved projecting ornament, which is in the way and is liable to get broken off,

should be eschewed. This fault is very common in French designs of the style of Louis XIV. The celebrated Chippendale and Sheraton chairs, although undoubtedly some of their carved backs are very beautiful, cannot be regarded as models of correct taste. The same may be said of Hepplewhite's, which are known by their shield and oval backs. The spindle-like filling and carving, in some examples, are very liable to be broken off by merely leaning against them. Chippendale's elegant "ribbon" chairs are condemned on the same ground. This maker borrowed some ideas of his furniture from the French, and introduced legs of double curvature for the front of his chairs, while at the back the legs remained square in plan. Loudon strongly condemns this fashion of loading the legs in front with ornament while the back supports remain square and devoid of decoration; but, of course, individual tastes differ in such matters.

This paper must now come to a close, but the writer sincerely hopes that the above remarks on the proper and natural outline of chairs may be found of use by the readers of WORK—to some in choosing their furniture of tradesmen, and to amateurs in constructing, or trying to construct, their own.

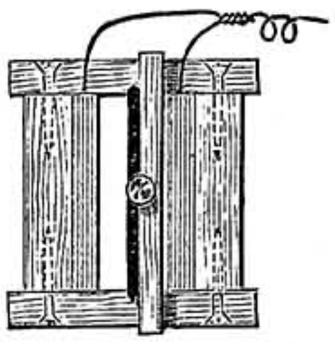


Fig. 1.

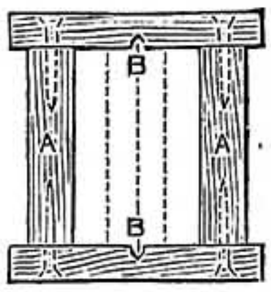
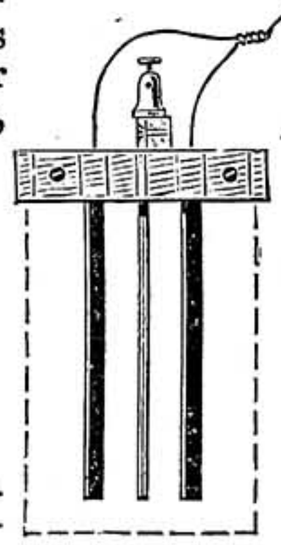


Fig. 2.



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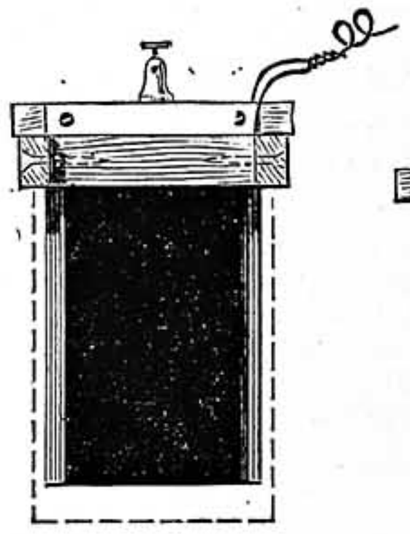

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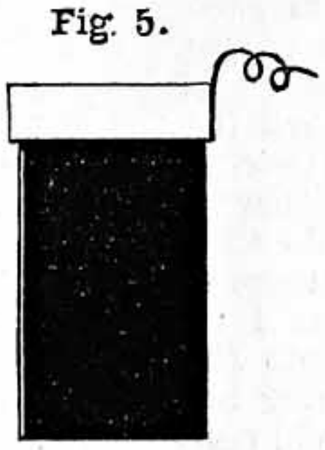

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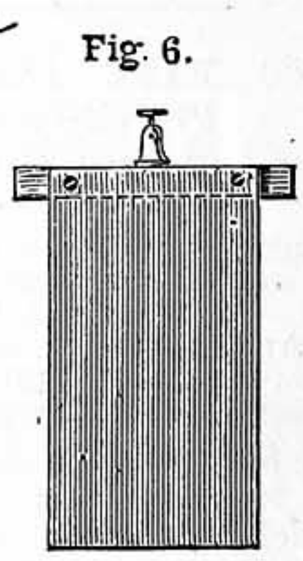

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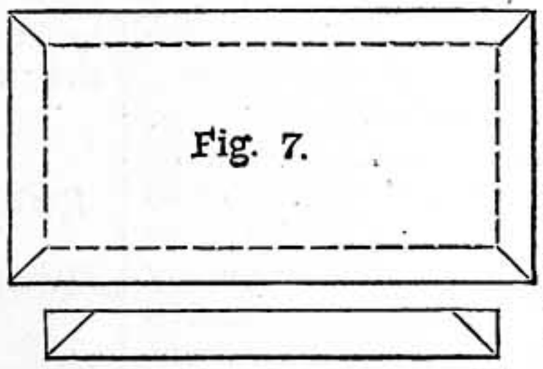

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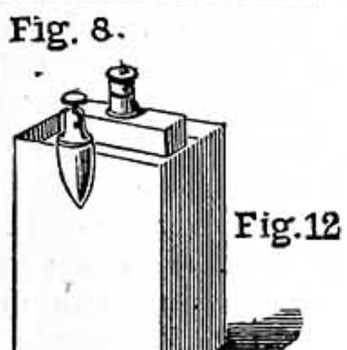

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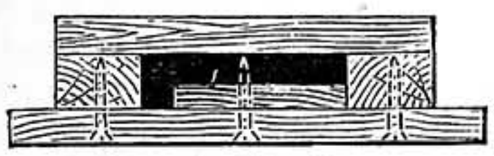


Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 1.—Plan of Frame and Elements complete. Fig. 2.—Plan of Frame—A, A, Struts; B, B, Grooves for Zinc. Fig. 3.—End View of Frame and Elements. Fig. 4.—Side View of same. Fig. 5.—Carbon complete. Fig. 6.—Zinc complete. Fig. 7.—Tin Sheet marked for turning up. Fig. 8.—The same turned up. Fig. 9.—Plan of Lead Cap Mould. Fig. 10.—Side View of same. Fig. 11.—Small Zinc Cover-Plate. Fig. 12.—Dry Battery Cell.

EASILY-MADE BATTERIES.

BY J. BROX.

INTRODUCTION — CARBONS—LEAD CAPS—FRAME — ZINCS — DRY BATTERIES — CELL CASES—CARBONS — MIXTURE — SEAL FOR TOP.

Introduction.—As a continuation and ending to my paper, showing how to construct a small model electro-motor, which appeared in Vol. III., No. 154 of WORK, I now propose to help you to make your own bichromate, or chromic acid, batteries and carbons in the simplest and easiest manner, with a short description of making a dry battery cell: which seems, somehow, to be a trouble to not a few. I have several of the double carbon single fluid batteries, which I now propose to illustrate, made exactly as shown, which give every satisfaction; they are not, I am sorry to say, things of beauty, but their simplicity of construction excuses that. The dry battery, on the other hand, is a very neat little article indeed, two of which have been ringing a small bell for the last ten months, and work as strong as when I first made them.

Carbons.—You must not, of course, expect that these carbons that you make yourself will be as nice-looking as the bought ones, but they are quite hard and close enough for all practical purposes. You will not also find very good results if you try to make them larger than, say, about 7 in. by 4 in.; but even taking this as a limit, there are many useful sizes coming below that measurement.

The first thing to be done is to make a wooden model of your carbon, then from some thick tin—the thicker the better for large sizes—cut out a square the size of your wooden model, plus its thickness, as in Fig. 7; cut the corners diagonally up to the wood, and with a hammer turn up the edges all round neat and square, turning in the corners as you would in making a simple card-tray, shown in Fig. 8; repeat this process again with another square of tin, but this time using the first tin, with the wooden model inside as a mould, so forming a lid. You must now go on a voyage of discovery into the coal and coke cellars, and get equal parts of coal and coke dust—you had better keep these separate for the present; sift these as fine as you can. I make my last sifting through a small sieve, made of gauze muslin. Take equal parts of each by volume, and mix them up together with treacle—a putty-knife is a good tool—on a flat stone; you must mix all well, and as stiff as you can get it: so stiff that you can hardly work it. If you have mixed it rightly it will have a little of the same trick as cold fresh-mixed starch; it will not stand violence, but will yield to gentle persuasion.

You must now fill the inner of your tin boxes, working in as much as you can, and well into the corners; put on the tin lid, and bind round and round both ways with thin iron wire, and fasten. Watch for a nice clear fire; the best is a hollow one: the kind that an old woman says "there is a parting" in. Put the tin mould in flat—as flat as you can; putting it in anyhow won't do. I spoilt one or two at first by doing so; the carbons came out all soft one end, and grand and hard the other. Let it stay in the fire until it is a bright red all over, and until there are no more little blue flames round the laps of the tin: a thing which you can't prevent with a tin mould; this will be in about a quarter of an hour or ten minutes after it is red hot; take it out, and let it cool slowly by leaving it close to the fire.

You can use your tin mould only three or, at the most, four times; the first two are always good. Of course the first is the best, but No. 3 is generally aldermanic, No. 4 Henry VIII. without a doubt; but still, Nos. 3 and 4 do very well for dry cells, where they are not seen, but as the tin moulds are so easily made, this does not much matter. I never use one more than three times. Any old tin will do as long as it is flat and turns up true.

Lead Caps.—To make the lead caps, make a good stout wooden box, as in Figs. 9 and 10, making the inside to the size you require; also see that the inside of the joints fit close and well. One side of this box must be put on with three or four wood screws, as in Fig. 10, so that you can slack it off when you take the casting out. To cast the heads on I cut a couple of shreds of lead, and place them in the bottom of the mould to rest the carbon on, as it is very hard to hold it steadily so that the lead runs underneath without support. Pour in the lead steadily, and do it in once; if you stop, it will leave an unsightly crack or join.

To each lead head, on one end of it, solder a piece of cotton-covered copper wire, the end of which you have previously flattened out well. In soldering on the copper wire, you will find the lead cap has become quite hot; while in this state give it a good coat of Brunswick black, working it well into the junction between the lead and the carbon, and down the latter for about ½ in. Fig. 5 shows a carbon and cap with wire tag. Of these carbons you will want two for each single fluid cell that you think of using.

Frame.—The frame to hold one set of carbons and the zinc plate for one cell, you will make with four pieces of wood, a plan of which you will see in Fig. 2. Fig. 1 shows the same with the carbons and zinc in their places. Fig. 3 is an end view, and Fig. 4 a side view, both with carbons and zinc. The size of this frame will depend upon the size of the jar you are going to use. The two strut pieces marked A, A, in Fig. 2 ought to be made very slightly shorter than the length of your lead caps, so that when these are in their places—viz., one close up to one strut, and the other close to the other—you can screw the whole up tight by the four wood screws, and the carbons will be held firm in their places.

On the two side pieces, in the middle, and on the inside, are two grooves, cut of a suitable width and depth, to slide your zinc plate down, shown at B, B, Fig. 2. The two copper wires will now stand up between the frame and the lead caps; one of these wires should be cut half as long as the other, and in

the middle of the longest untwist some of the cotton cover; and join the end of the shortest to the bare place, thereby making connection between the two carbons, and a means of joining up to the next cell; this is shown in Figs. 1, 3, and 4. The whole frame and lead caps should now have two or three coats of Brunswick black.

Zincs.—These should be cut out of rolled sheet zinc, not less than $\frac{1}{8}$ in. in thickness, however small the battery may be you mean to make, well cleaned and amalgamated. In the two top corners of your zinc drill two holes, and screw it on to a small strip of wood long enough to rest on the sides of the frame when the zinc is slid into the two grooves. Fig. 6 shows a zinc.

Between the wooden strip and the zinc at the top make a hole with a bradawl, and screw in an ordinary binding screw; the strip and the zinc for about 1 in. below the wood should have two or three coats of Brunswick black.

This simple way of treating the zincs is handy, for the reason that when they are nearly used up one end, it is little trouble to take them off, clean them up, etc.; drill holes in the other ends and reverse them.

The fluid mixtures—so many times given in this paper—and the jars I leave to your discretion. The sketches are to no scale, as you may have observed; all I have endeavoured to show you is an easy and simple system of making the elements for double carbon and zinc batteries in general.

Dry Batteries.—As regards dry batteries, I have noticed that they are somehow or other a thorn in the flesh to many. Not so long ago a man with an electric hobby came to me in great trouble; he had made a dry cell, a very neat little box one, and beautifully finished; but not a vestige of current would it produce. I asked him how he had made it, and he told me. Everything seemed as it should be; his mixture was a good one, but still, it would not work. I told him all I could do was to cut out one side and have a look at it. This he did not seem to relish; but I wanted to have a look at the inside without disturbing the contents. This soon brought the trouble to light: his carbon plate was resting tight on the zinc bottom, thereby short-circuiting the cell. His dry battery works well now.

Cell Cases.—The box cell, shown in Fig. 12, is made of rolled sheet zinc, neatly soldered up together, with a binding screw soldered on to the outside of the top; and to give a finished appearance, a small cover-plate of zinc, made in shape like Fig. 11, is soldered round the tag of the binding screw. After you have dressed up the outside of the box smooth with a file, put it in an oven, and get it so hot that it is *just* unpleasant to hold; then give it a coat of Brunswick, going over the top and down the inside for about $\frac{1}{2}$ in.; after this is dry, give it two more coats.

Carbons.—You can use for the carbon, if you like, one of the aldermanic ones which came out of your tin moulds, and was not good-looking enough for the other purpose; but have a nice lead cap on the top. You can have a copper wire tag on the head, but a small binding screw in the middle looks much better, and is more useful, as in the sketch, Fig. 12. A hole is easily drilled, and the screw soldered in.

Mixture.—There are several mixtures for filling dry cells, some of which are secrets; some are complicated, others simple. The one I shall offer to you is a very simple one. I have used it myself; and as it works well—in fact, better than I expected when I first made it—you can, I think, use it with advantage.

I took some ordinary killed spirits of salts — viz., common hydrochloric acid saturated with zinc; this I slightly warmed, and again saturated with sal-ammoniac. With this simple solution I made a thin mixture with plaster-of-Paris; then putting two stout small indiarubber rings in the bottom of the zinc box to insulate the carbon, I held the carbon in its place, and filled up the box to within $\frac{1}{4}$ in. of the top with the creamy mixture. When this had somewhat set, two pieces of wood a little thinner than pen-holders were run down to the bottom on each side of the carbon plate, and left there.

Seal for Top.—The seal that was used for the top was some old Brunswick that had got hard, which was melted in a tin, and then run over the top. When this was nearly set hard, the two sticks of wood were given a twist and carefully pulled out, leaving a hole on each side of the carbon for the escape of gas. Two little cells made like this, as I said before, have been ringing a small bell for the last ten months through about twenty-four yards of wire; how much longer they mean to go I cannot say. When they do show signs of weakness, I shall stand them each a small drink of the same solution I made them of, which they can take into their inner selves by their small breathing holes, and I doubt not but that they will revive again.

HOW TO MAKE AND WORK THE SPECTROSCOPE.

BY CHARLES A. PARKER.

PRISMS—QUALITY OF GLASS USED FOR PRISMS—HOW TO MAKE A BISULPHIDE OF CARBON PRISM — CUTTING AND GRINDING GLASS — CEMENTING SIDES OF PRISM TOGETHER — FILLING PRISM—BISULPHIDE OF CARBON — WOODEN FRAMING FOR PRISM.

A PRISM for spectrum analysis should invariably be made of the best dense flint glass, which, by the way, has nearly double the dispersive power of crown glass. An ordinary dense glass prism as usually employed for this purpose will have a section which is an equilateral triangle, giving an angle of about 60°. The angle should not be smaller, otherwise the spectrum is too short; and, on the other hand, if it is too great we shall get no spectrum at all, as the light will be reflected back without emerging from the second refracting surface. Flint glass possesses a much greater dispersive power than water, and bisulphide of carbon more so than flint glass.

A very useful hollow glass prism (similar in appearance to Fig. 4) can be formed by enclosing a liquid between glass surfaces suitably inclined and cemented together, and provided that the plates employed for this purpose have perfectly parallel surfaces, the refraction of the rays will be entirely due to the liquid itself. Assuming that the student will be desirous of constructing his own prism, it may be desirable to describe the practical construction of a bisulphide of carbon prism of this description which will be eminently suited to the requirements of spectrum analysis.

The refracting surfaces of the prism are formed of three pieces of glass accurately ground and cut to a uniform size of 2 in. by $1\frac{1}{2}$ in., using for this purpose the best patent plate or, better still, plate glass. The edges should now be accurately ground by being rubbed on a piece of iron plate with fine sand and emery powder until they are all three of a uniform size. It is best to grind the edges with sand, as this will give a coarser surface to the glass, which will hold the glue more firmly in the subsequent operation of cementing the prism together. When these three pieces have been prepared for the sides, a couple of triangular pieces of thinner glass should be cut and ground to the plan of Fig. 5 to form the top and bottom of the prism. They may, with advantage, be cut from a piece of ground glass, and it will be necessary to provide one piece with a small hole, through which the prism may be filled; the hole can be readily bored by means of a rat-tailed file with the extreme point broken off. The file, which should be held in the right hand, is rapidly rotated in a slanting direction, with the thumb close against the glass, in order to increase the pressure, and likewise to prevent the file from pressing through the glass when the hole is finished. The drilling may be done much quicker if the point of the file is occasionally lubricated with water or, better still, oil of turpentine; and, if necessary, the orifice may be afterwards enlarged by working the file in the usual manner. The hole should be bored before the glass is cut and ground, in case the glass should happen to crack during the operation and be rendered useless.

The prism constructed by the writer is formed of three pieces of good plate glass 2 in. by $1\frac{1}{2}$ in. by $\frac{1}{4}$ in., accurately bevelled on their inner sides, so that they fit together in the manner shown by the plan of the prism in Fig. 6. Although there is much more labour attached to making a prism of such thick glass, yet it is in the end an advantage, as the bevelled sides afford a firmer hold for the cement, and render the prism much stronger and more rigid than can be obtained by the use of thinner glasses. If the sides are made of thick glass, the top and bottom will not require to be increased in thickness, as thin glass will answer the purpose quite well enough; in fact, it is really better to use thin glass for the purpose, owing to the necessity for boring a hole through the top piece.

The greatest difficulty experienced by the amateur will, doubtless, be in the cutting and bevelling of the glasses, and, as it is absolutely needful for this to be done accurately, it becomes an awkward task to accomplish without the necessary appliances. It may, perhaps, be possible to get such a job performed at a glass grinding and polishing works, although, as a rule, these people do not care to undertake such small work. It is, however, comparatively easy to get a job of this description done in London. When the five pieces of glass have been prepared in the above manner, they will be ready for cementing together to form the prism. As carbon bisulphide is capable of dissolving all resinous substances, it will be impossible to put the prism together with ordinary glues or any similar cement. The writer considers Le Page's fish glue to be the best cement to use for this purpose.

The three pieces of glass which form the sides of the prism should be carefully cleaned, and then glued in position on the triangular piece of glass which forms the bottom of the prism, care being taken not to smear the glue on the glass, but to get just a thin unbroken line of it floated along the junction of the bottom with the sides *inside the prism*, the same care being exercised with regard to the apex of each of the

sides. It is by no means an easy matter to get the glue to flow in an even line along all the joints of the prism, but still it can be accomplished by the exercise of a little care and patience. On no account should too much glue be used at a time, otherwise it will be apt to run away from the joint before it has had time to dry. If thin glass has been employed for the sides, it will, doubtless, be advisable to hold them together temporarily at each apex by means of strips of postage stamp edging stuck along the outside of each joint, removing these when the glue is dry, and filling up the spaces with fresh glue. While the glue is drying, and until the top is put on the prism, the inside should be protected from dust by loosely covering the open end with a piece of paper; or, if preferred, it may be stood upside down, as it is absolutely important that the inside should be kept clean and free from dust.

When the glue has become quite dry—and not till then—the top piece of glass with the hole drilled through may be glued on to the top of the prism. When doing this, it will be found the best plan to put the glue, not only on the top edge of the prism, but draw a thin, unbroken line of it all round the inner edges, so that when the top glass is pressed into close contact the whole can be turned upside down, thus causing the glue to sink slightly and, consequently, run completely round the edges. The prism should now be put in a cool place so that the glue may dry slowly, as, if the drying is forced by the aid of heat, it will cause the glue to crack and leave chinks between the two surfaces. When the glue is quite dry, all the joints on the outside should be carefully looked over and levelled with glue wherever necessary, after which the prism will be ready to be filled with about $\frac{3}{4}$ oz. of pure bisulphide of carbon. This may be done by pouring the liquid through a small pipette, which takes the form of a short length of $\frac{3}{8}$ in. soft glass tubing drawn out at one end to a fine point in a gas flame, thus forming a kind of small funnel. The prism should be filled as quickly as possible and the aperture immediately closed with a small piece of cork previously cut to fit the opening tightly, after which the cork is cut off short and then covered with several layers of glue, in order to make it air-tight, each succeeding layer being allowed to become quite dry before the next is laid on.

The reader should be particular to obtain the bisulphide of carbon chemically pure, as the ordinary commercial quality, which generally has a yellowish tinge, is unsuited for that purpose. As bisulphide of carbon emits a particularly obnoxious odour, it will be found advisable to fill the prism in the open air; or, if it is done in the house, the windows should be opened after it has been done, in order to get rid of the smell. The student should also be very careful to keep clear of any naked flame when using this liquid, as it is highly inflammable.

Should the prism be found to be leaking at any time, it will be necessary to empty the liquid back into the bottle, and then cover the leak with some fresh cement, any defect of this kind soon making itself apparent by the smell. Sometimes it may happen that the leak is on the inside, in which case it will be needful to take the whole of the prism to pieces; in the event of this being requisite, the glass plates may be loosened by soaking the empty prism in warm water for some time, after which the softened glue is scraped away, and the whole cemented together again with the greatest possible care.

When the prism is not in use it will be found advisable to keep it in the dark, as pure bisulphide of carbon, which is a white, transparent liquid, becomes slightly yellow by the action of daylight, more especially so when it is placed in direct sunlight.

It will be found to add considerably to the appearance of the prism if the sides are covered with a piece of thin black paper, which is carefully pierced with three openings, each the size of a penny-piece, and

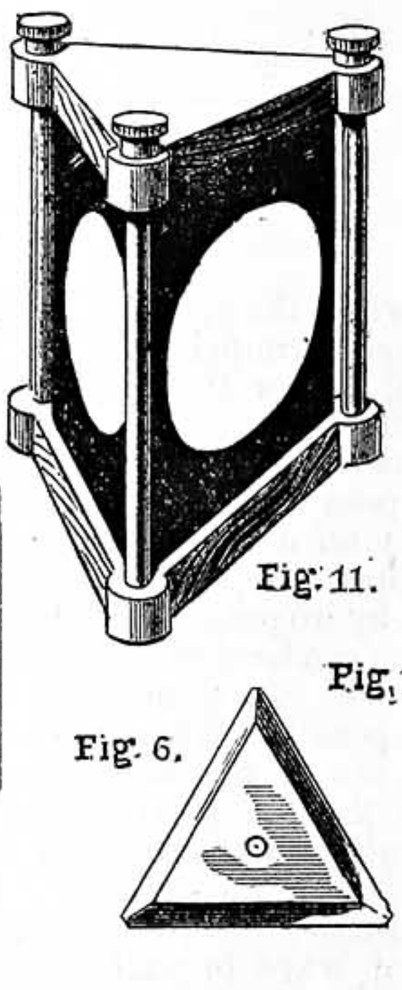


Fig. 11.

Fig. 5.

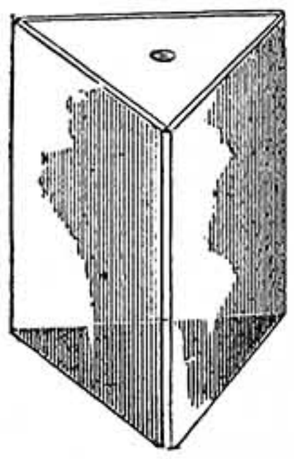


Fig. 4.

Fig. 6.

Fig. 10.

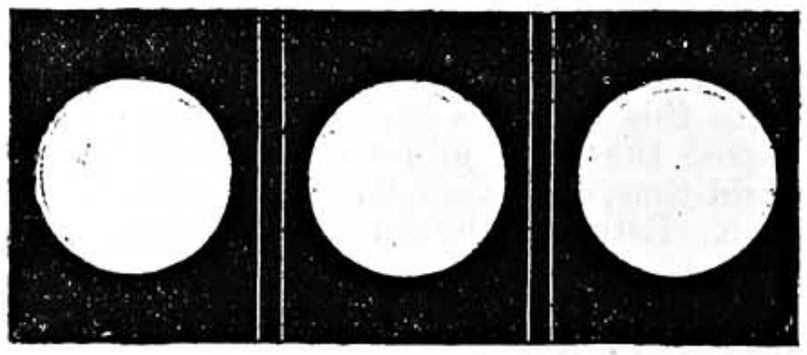


Fig. 7.

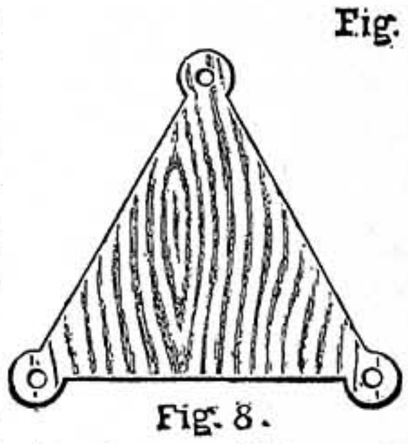


Fig. 8.

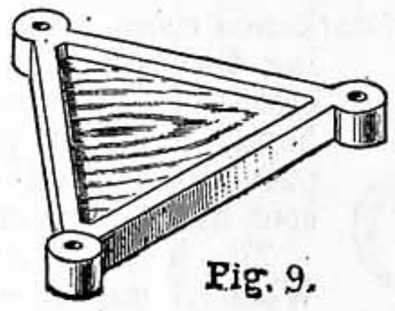


Fig. 9.

Spectroscope. Fig. 4.—Hollow Glass Prism. Fig. 5.—Plan of Prism. Fig. 6.—Plan of Hole in Prism of Plate Glass with Bevelled Edges. Fig. 7.—Black Paper Mask for Sides of Prism. Fig. 8.—Plan of Wooden Frame for Prism. Fig. 9.—Framing showing Mortise to take Prism. Fig. 10.—Brass Pillar with Nut. Fig. 11.—Prism mounted complete.

suitably arranged so as to occupy the centre of each of the sides when the paper is cemented on to the glass with fish glue, or, better still, with some strong shoemaker's paste. This paper mask is shown in Fig. 7. Nothing remains now to be done but to provide the prism with a wooden frame, as shown in the illustration. The seating for the top and bottom is formed of a couple of pieces of $\frac{1}{4}$ in. mahogany, ready polished and fret-cut to the shape of the prism, but just $\frac{1}{8}$ in. larger on all sides, with a semi-circular curve at each angle, as shown in Fig. 8. The top and bottom of the prism is made to bed into a mortise prepared for its reception in each piece of wood by the aid of a keen chisel, in the manner shown in Fig. 9; the polished sides naturally being uppermost. A hole is bored through each angle of the wood by means of a fine gimlet, or, better still, a red-hot wire, as there will be less likelihood of the wood splitting if this course is pursued; and when this has been done, three $2\frac{5}{8}$ in. lengths of $\frac{1}{4}$ in. brass rod should be reduced in diameter at each end by means of a file, after which the upper end of each one is tapped with a screw thread, and then provided with a small screw nut, as shown in Fig. 10; the lower end of each one being afterwards cemented into the holes in the bottom seating of the prism by means of Prout's elastic glue, after which the top wooden cover is slipped on and secured in position by means of the screw nuts. The sawn edges of the wood will, of course, be required to be trimmed up with a file, and then varnished; and it will also be advisable to lacquer the rods and nuts. The appearance of the prism when complete will be seen by reference to Fig. 11. It is always advisable to make the prism first before starting upon the construction of the spectroscope itself, as it will sometimes happen that a bisulphide prism, made in the manner above directed, will appear to be perfectly sound for a week or two, and then start leaking in consequence of some slight defect in the cementing of the joints. In the case of the prism constructed by the writer, a mishap of this kind occurred at the end of a week or so after filling, in consequence of which it had to be taken to pieces and refilled, only to leak again in a few days; but after being again filled, with that extra care which is the outcome of experience, it has remained perfect ever since.

In the next paper I shall describe the preparation of the adjustable slit. In the meantime, the reader will find ample employment in the construction of the prism just described.

PHOTOGRAPHIC EXPERIMENTS.

CURIOUS, AMUSING, AND INSTRUCTIVE.

BY WALTER E. WOODBURY.

INTRODUCTION—PHOTOGRAPHING THE INVISIBLE—TO MAKE PLATES THAT WILL DEVELOP WITH WATER—PHOTOGRAPHS WITHOUT LIGHT—TO MAKE SILHOUETTE PORTRAITS—LUMINOUS PHOTOGRAPHS—TO MAKE A STRONG PRINT FROM A WEAK NEGATIVE—COMICAL PORTRAITS—TO RESTORE FADED PRINTS.

Introduction.—The beautiful art of photographing is rapidly becoming more and more popular as a pastime. It affords an endless amount of instruction and amusement. The number of amateur photographers in this country is already incredibly large. It is to be regretted, however, that the majority of those who practise the art for pleasure content themselves with the simple routine involved in the making of a negative and from this a silver print.

With a knowledge of the art a thousand different experiments can be made, which not only afford considerable instruction, but are, in some cases, very amusing and entertaining.

I have in the following collected a number of instructive experiments, useful formulæ, and amusing dodges, which I hope will be of use to many of the readers of WORK who already understand and practise the black art. With the aid of expensive apparatus it is, of course, possible to produce many other beautiful effects; but as I fear that all readers of this Magazine are

not troubled with an abundance of superfluous cash, I have only included those which can be conducted without much trouble or expense.

Photographing the Invisible.—The following is a curious and interesting experiment, based upon the peculiar property possessed by fluorescent substances of altering the refrangibility of the chemical light rays. Take a colourless solution of bisulphate of quinine, and write or draw with it on a piece of white paper. When dry the writing or design will be invisible, but a photograph made of it will show them very nearly black.

To Make Plates that will Develop in Water.—Some time ago dry plates were placed on the market which would develop, apparently, with water and a little ammonia only. The secret of the method was that the backs of the plates were coated with a soluble gum, containing the developing agents, and, of course, when the plate was immersed in the water, they instantly dissolved and formed the developer. Plates thus prepared are useful in travelling, where it is not always possible to get the necessary developing solutions. To prepare them the backs are coated with the following mixture :—

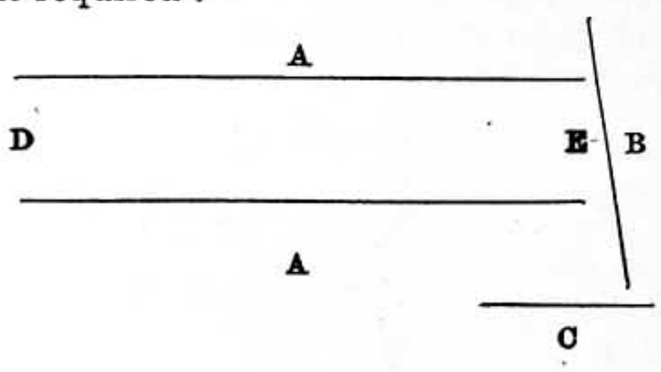
Pyrogallic acid	...	154	grains
Salicylic acid ...	...	15	„
Gum or dextrine	...	154	„
Alcohol ...	...	1	fl. dr.
Water ...	...	5	„

This is allowed to dry at an ordinary temperature. After exposure, all that is necessary to develop is to immerse the plates in water containing a small quantity of ammonia.

Photographs without Light.—A curious experiment, showing that a photographic dry plate can be otherwise affected than by light, so as to form an image upon it, is the following :—

An image of copper in relief is necessary—a penny will do for this purpose. Place an unexposed dry plate in a normal pyro-developer, and on it lay the copper coin. After about five minutes or so, remove the penny and wash the plate, when a perfect image of the penny will be found on it.

To Make Silhouette Photographs.—Silhouette photographs were at one time very popular. Some very curious and pleasing results can be obtained with them, and very simply. Hang up a white sheet at one end of a room, near a window, and then improvise a dark tunnel. The accompanying diagram will serve to illustrate the arrangement required :—



B is a white sheet, and A, A, the sides of the improvised tunnel ; C is the window, D the camera, and E the subject to be photographed.

Focus the figure as accurately as possible, and expose very rapidly for the background only, as no detail is, of course, required in the figure. Develop as usual, preferably with a hydroquinone developer, as a blacker negative can be obtained. The weak shadows of the feet can afterwards be touched out with a pencil. When properly printed the effects are very good, and serve to remind one of the old portraits cut out of black paper which were so much in vogue in the days of our grandmothers.

Luminous Photographs.—There are several different ways of making these. Obtain some Balmain's luminous paint, and coat a piece of cardboard with it. Place this in the dark until it is no longer luminous ; place this behind a glass transparency and expose the light, either daylight or, if at night-time, burn a small piece of magnesium wire. Return to the dark, remove the transparency, and a luminous photograph is obtained on the prepared card. A simple plan is to merely expose a piece of the prepared cardboard to the light and place it behind a transparency ; then retire to a darkened room. The luminous paint, showing through it, will have a very pretty effect. If no glass transparency is at hand, a silver print can be used, if previously oiled and rendered translucent by vaseline or any other means.

To Make a Strong Print from a Weak Negative.—Amateurs, as a rule, are very liable to get a number of weak, thin negatives, which, apparently, have no printing qualities. To remedy this a very effective plan is to place over the printing frame containing the negative and paper a sheet of green cathedral glass. This has the effect of retarding some rays and allowing others to pass through, and, by this means, a much more brilliant print, with greater contrasts, is the result.

Comical Portraits.—The tyro's first attempts at portraiture usually result in a lot of comical effects ; but, as they are not intended to be humorous, the effect is not so good. Better it would be to endeavour to make really humorous effects. These are very simple. If the amateur is a bit of an artist, the matter is simple enough. A good plan is to obtain a large piece of cardboard ; cut a round hole out of it sufficiently large as to just allow an ordinary-sized person's head to go through. Underneath this hole a small grotesque body is drawn or painted. The sitter's head is then pushed through, and the whole photographed. The effect is very funny, especially if the body is well done. A hundred different ideas will at once form themselves, such as a little man sitting in a balloon or flying in the air on a broomstick, etc.

To Restore Faded Prints.—Prints that have faded and gone yellow can be restored in the following manner. Two solutions are required.

Solution No. 1 : Tungstate of soda, 3½ ounces ; distilled water, 175 ounces.

Solution No. 2 : Carbonate of lime, 62 grains ; chloride of lime, 15½ grains ; chloride of gold and sodium, 62 grains ; distilled water, 14 ounces.

Solution No. 2 must be prepared in a yellow glass bottle, well stoppered, and allowed to stand twenty-four hours before use. It is then filtered into another bottle of yellow glass, and well corked to preserve it. For use, take 6 ounces of No. 1 and from 1 to 2 drachms of No. 2 solution. The prints, having been well washed, are placed in this solution one at a time. The strengthening should not be too rapid. In summer ten minutes should suffice, nor should the bath contain excess of gold chloride. If correctly used, a clear purple colour is obtained. The next operation is to fix. For this, take 6 ounces of No. 1 to 4 drachms of hyposulphite of soda. The prints are well washed, placed in this solution one at a time, and soaked in it until the yellow colour has entirely disappeared. This will, in some cases, require three or four hours. When it has entirely disappeared the restored picture is well washed and dried.

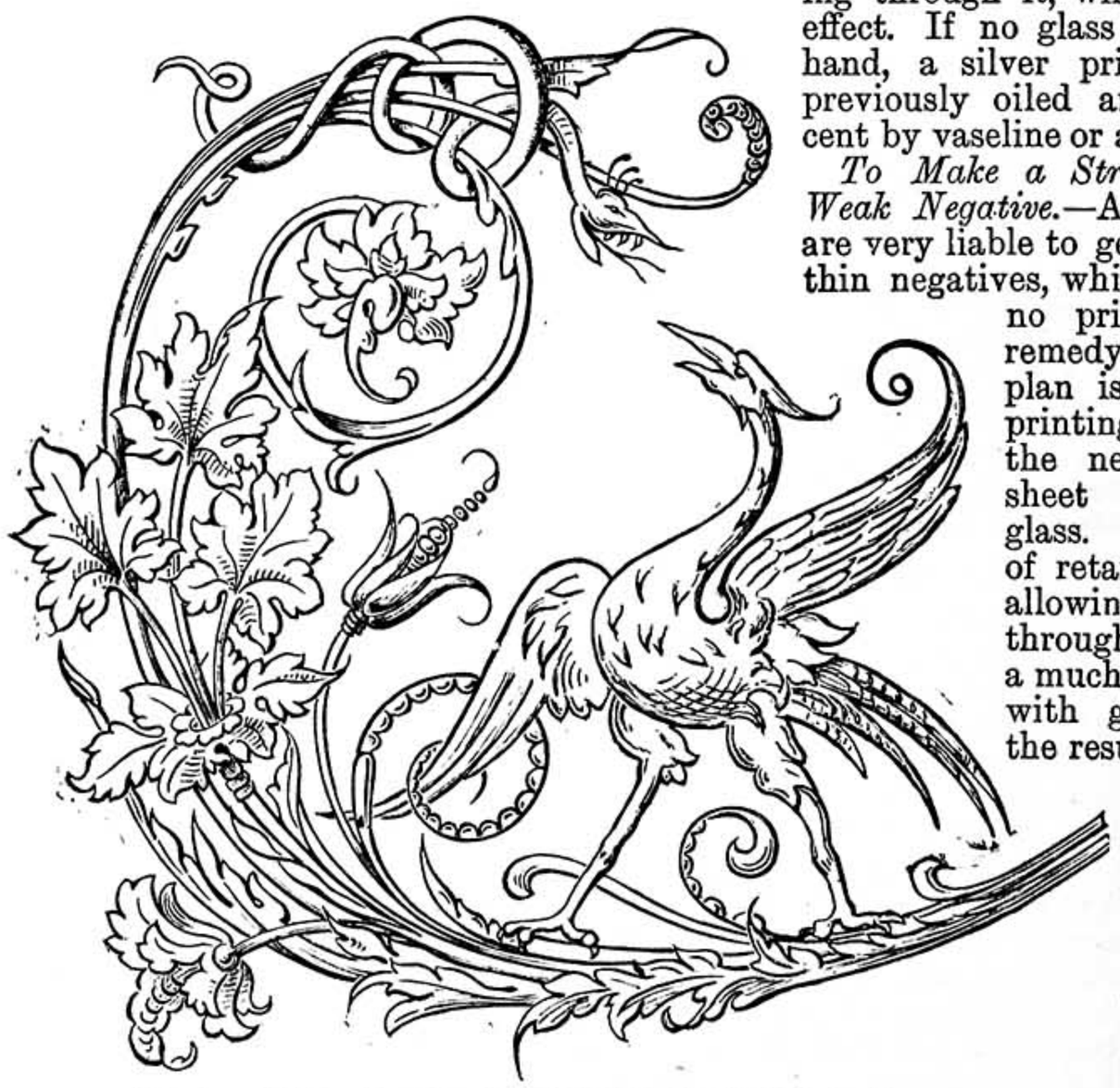


Fig. 5.—Italian Renaissance Design for Panel or Screen.

MEANS, MODES, AND METHODS.

A Strong Liquid Glue.

Take of clear gelatine, 100 parts ; the best Scotch glue, 100 parts ; alcohol, 25 parts ; alum, 2 parts ; with 200 parts of 20 per cent. acetic acid, and heat in a water bath for six hours. An ordinary liquid glue, also well adapted for uniting wood and iron, is said to be made by boiling together, for several hours, 100 parts glue, 260 parts water, and sixteen parts nitric acid. This glue will join wood to metals.

Stopping for Nail-holes, etc.

Take fine sawdust and mix into a thick paste with glue, pound it into the hole, and when dry the wood will be found to be as sound as new wood. It is said that this mode of stopping has been adopted with complete success in repairing bellows, which is the most severe test known. Often, by frequent attachment of new leather to the boards of old bellows, the wood becomes so full of holes that there is no space left to drive in fresh nails, and even if there were, some of the holes that had been already made, and had found their way to the interior, might allow the air to escape. This treatment with glue and sawdust paste invariably produces the desired effect. To all woodworkers and cabinet makers also this should prove useful.

POKER WORK, AND HOW TO DO IT.

BY JULIE NÖRREGARD.

THE dolphin, in our next pattern (Fig. 3), can be used for a variety of articles, but would, perhaps, look best finished off with a small border all round on a square box for pocket-handkerchiefs; boxes are used so much now, many ladies preferring them to the soft sachets; they can be ordered at the art stores in white wood, and in any size. No. 4 of our illustrations is a very effective pattern, which would give a highly decorative character to a shelf for the wall. These little shelves form an important part in our wall decoration, and are seen nowadays in almost every drawing-room, loaded with china or bits of old silver. I saw one the other day made in perfect proportions; the shelf itself was 9 in. wide, and it was finished off in front with a low balustrade about 1½ in. high, just to guard all the little knick-knacks without hiding half of them; a piece of wood 15 in. deep was screwed into the wall, thus giving support to the shelf; on this plain piece of wood a pattern, something similar to the one given in our columns, was beautifully done in wood etching, and it looked simply lovely; the background nearest the griffin was burned very dark, being toned gradually down to a pale shade, so that the long, elegant-shaped flower stood out from the natural colour of the wood.

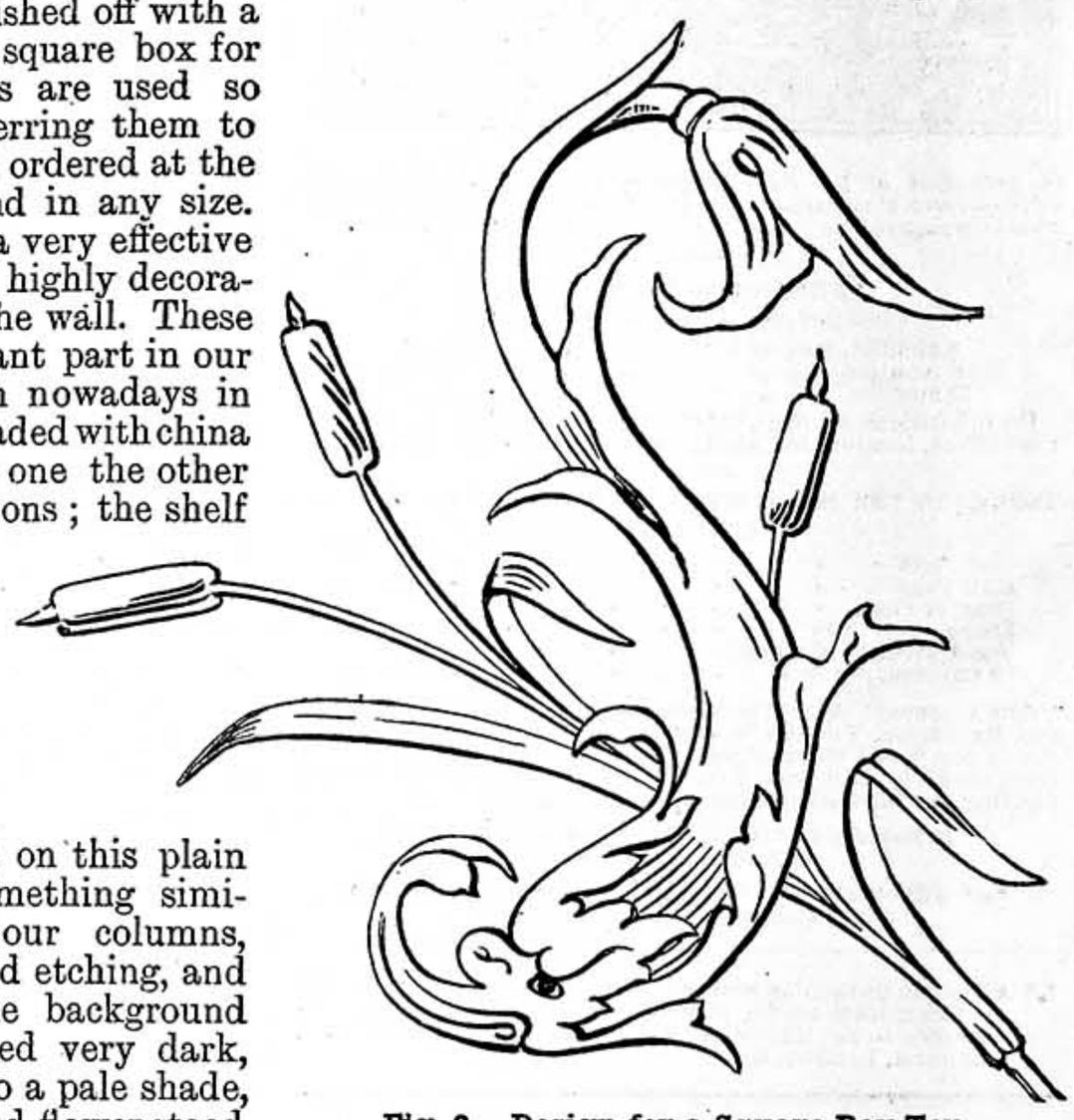


Fig. 3.—Design for a Square Box Top.

I have heard people talk about wood etching somewhat with disdain, just because they have happened to see some rubbish in that work, as they might in any other form of art; but I think it is rather unjust for that reason to dislike the work itself, for when it is properly done by a thoroughly artistic person, it is really most effective, and should be regarded as true art. With this, however, as with every other branch of *les beaux-arts*, one must learn "to walk before one can run," as the saying is.

The design in Fig. 5 is not quite so easy; but when you have practised on a good many other things, and can handle the red-hot tool as easily as a pencil or brush, it might be attempted, and on a panel or screen the pattern would look very beautiful. The first difficulty lies in all the fine lines, which, to look well, must run smoothly and evenly; the next consists of the shading, which represents many tones of colour, from the darkest walnut to the palest cream. As the design is in the rich Renaissance style, it must never be used on any Oriental shaped table or screen, this mixture being atrocious to the artistic eye.

My readers will see that the designs which have been selected are all in the so-called conventional style; this must not, however, give the impression that no other styles are suitable for poker work; far from it, for some of the most lovely patterns consist of flowers and birds, of which any number of beautiful specimens can be hired at any art shop for a few pence, whereas the conventional designs are considered much more difficult to obtain, unless you are a subscriber to one or two of the art papers.

To the highest cultivated artist in pyrography everything will come in as a motive, and in this art there are landscape as well as portrait painters, who cleverly and successfully make their living by etching scenes from human life on their wooden "canvas."

I must give a few directions about finishing touches. If much time and trouble has been spent, the work should be polished; as this is not such an easy matter, I should advise the article being taken to an authority, who will understand how to heighten its value and beauty. But should the work be in a coarse style, effective, but without claiming to be first-rate art, it will be sufficient to use French polish; two or three coats of this should be applied with a soft brush, but it should be allowed to dry between each coat. I have seen some people use a combination of beeswax and turpentine, but, although it looks nice for a short time, it soon loses its effect. If the work should lose its fresh appearance, getting black from the London smoke and fog, it can be perfectly well cleaned by slightly rubbing it with indiarubber and bread-crumbs; this, however, should only be done when absolutely necessary. Many students of pyrography like to do the ground part of the work in various patterns, and for this purpose tools are made with separate points, in different shapes, such as stars, half-moons, and flowers. But this is a style which must be accepted with care, for in many cases it is apt to give a common and rather inferior character to the work; and, for my part, I think that the work with the softly shaded background is much more artistic.

I shall be glad if these simple lines have the effect of awakening an interest for this work, so that some new students may be added to the ranks of those who can already master the tool with skill and taste, but it must be remembered that one single piece of work done with love of art, and care, is much superior to a dozen articles executed in that half-hour style which spoils the good taste of both the worker and the admirers. All beautiful work requires time and labour, and when it bears an impression of haste it is no longer a thing of beauty.

Fig. 4.—Pattern for a Shelf or Panel.

Self-Educators for all Workmen.

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TECHNICAL TEACHERS.—*À propos* of obtaining teachers of technical classes, can we wonder that it is difficult to find capable instructors when all the bearings of the case are considered? If he is to be a successful teacher he must be well up in his particular trade. Then, leaving out the matter of payment, which, being often dependent on the results of an examination, may give him nothing at all, if it happens that the examiner sets questions quite unsuited to the master's view of the subject—a difficulty which the short syllabus issued by the City and Guilds Institute does not overcome—forgetting, we say, the financial point, are other surrounding circumstances such as would tempt a good workman to take upon his shoulders the burden of preparing lectures and supervising the practical work for classes? With many of his fellow-workmen he knows that his efforts will be harshly commented upon, while his employer will barely tolerate, if he does not altogether discourage, his teaching. Here he begins to speculate as to whether technical education is, or is not, the right thing. So much for the immediate environment. What help is he able to count upon from the leaders of his trade? Then, where is he to go for information as to the way in which such classes should be conducted? He knows that technical education has been in practice in France and Germany for years, and a knowledge of the way they do these things on the Continent would be an assistance. Where is such information to be obtained? At the Central Institute for the advancement of Technical Education, South Kensington? Nothing in the way of a special library, however, is in existence, there or elsewhere. Do these few considerations supply an answer to the question which has arisen in Birmingham, where recently it was suggested to send to the Continent for a teacher in bronzing and electro-plating. We feel sure that there are plenty of Englishmen quite capable of teaching this subject, but the conditions surrounding the work and the terms offered are not such as to attract suitable first-class men, and to let technical instruction drift into the hands of second or third-rate men is always a blunder. Technical propagandists should speak up.

SATURDAY AFTERNOON EXCURSIONS.—A very good proposal has been put forward in the daily press. It is that the railway companies should run cheap trains on Saturday afternoons, so as to enable workmen and their families to have a few hours in the country during the week-end half holiday. People of leisure, and with better-filled purses than the average workman, have little idea what a boon this would be. Too often the workman, finding himself a bit dull with nothing to do on these Saturday afternoons, is tempted to waste his time and money. The railway companies have it in their power to do much for the workers, and thereby to put money in their pockets. We have already had occasion to refer to workmen's trains on the G.E.R., where journeys of eleven miles are profitably given for a penny. Let excursions on something like this scale of charges be run, and the numbers that will flock out of town will make that class of traffic much more remunerative than any other railway traffic. Conveyance in these days of steam is cheap—cheaper than the railway companies have ever given us any idea of. A train with accommodation for 600 persons is not a particularly large train; yet the railway companies let the seats in the train at a penny each per mile—*i.e.*, at 50s. per mile for the whole train. Now, the total cost of running a train is 2s. 6d. per mile—that covers not only moving expenses, but maintenance of way, and stock, and stations; in short, everything. Thus the companies offer to the public at £2 10s. what costs them only 2s. 6d—a net profit of 2,300 per cent.! Of course, the public doesn't buy the article; it buys only what it absolutely requires, just as it does in the case of every other exorbitantly priced article, and instead of getting £2 10s. per passenger train mile, the companies get only a paltry 3s. 6d.—the rest of the train is wasted. To Brighton and back for 3s. is called a cheap trip. It is really a very dear trip. If 400 passengers go by such a trip, the company nets £60; its total outlay is £12 10s., at 2s. 6d. a mile for 100 miles. It thus nets a profit of close on 500 per cent. A *very* cheap trip this!

"WORK" POSTAGE.—Judging from the letters we are constantly receiving, there would appear to be misapprehension in the minds of some of our readers concerning the postal tariff for WORK. It cannot be too clearly stated that the postage for each weekly number is one halfpenny, whether the address be in the United Kingdom or abroad. In other words, a halfpenny postal wrapper will frank WORK weekly numbers to practically any point of the civilised globe. Though not registered as a newspaper, the weight of the weekly issue is under two ounces, which enables us to come under the privileges of the Post Office by which newspapers, or otherwise, not weighing more than two ounces can be posted in Great Britain or abroad for one halfpenny. This should prove a boon to those who, living at a distance from a town, prefer to order the journal from its publishers by post. Still more advantageous is it when it enables readers at home, with friends and relations at a distance, to keep in touch in a useful and practical way for the mere trifle involved in a duplicate copy of the journal each week.

DESIGN AND DECORATION OF ALL AGES.

BY M. H. C. L.

Savage Ornament.

It is a curious and interesting feature in the history of mankind that the decorative instinct is one of the first to assert itself. People put on ornaments before they learn to put on clothes. A thoughtful writer sees in this fact a suggestion that the right principle to go upon in educating children's eyes and fingers is to begin by teaching them to produce things ornamental, and thus to lead them on to the production of useful things. However this may be, it is certain that the early development of the taste for ornament and the universal desire to decorate whatever we see are matters well worthy of attention.

The result of the all-prevailing tendency to decorate is this: everything about us bears the impression of art—good or bad—and we are ourselves sure to produce, or cause other people to produce, a considerable amount of decoration. And thus, indirectly though it be, we shall each individually have our share in forming the taste of our age. And without knowledge to guide our fingers in whatever handiwork we undertake, even though it be but the simplest piece of embroidery, without the taste that is born of knowledge to guide our

Savage Ornament. Fig. 1.—Nicobar Isles. Fig. 2.—Andaman Isles. Fig. 3.—Fiji Isles. Fig. 4.—Peru. Fig. 5.—Guiana. Fig. 6.—Mexico. Fig. 7.—Assam. Fig. 8.—Samoan Islands. Fig. 9.—Borneo. Fig. 10.—New Zealand. Fig. 11.—New Guinea. Fig. 12.—Solomon Islands. Fig. 13.—North American Indian. Fig. 14.—Paraguay Indian. Figs. 15, 16, and 17.—Saibai Islands. Fig. 18.—S. Africa. Fig. 19.—Arctic American.

choice in furnishing and adorning our surroundings, we are certain to bring into existence more ugly things than beautiful, bad combinations, inharmonious colourings, and above all, barbarous applications of design. It is in the direction of design that we are most likely to fail, because it is here that the greatest ignorance prevails. In colour we have of late years had some general education. The work of our painters (work largely seen and appreciated), the introduction of Eastern fabrics, and the caprice of fashion, which for some time brought artistic shades into vogue in women's dress, have all done something in training our eyes to appreciate what is lovely in hue, and avoid the glaring bad taste of fifty years ago. The spread of education has disseminated general ideas of proportion and harmony, so that we should not be likely, for example, to put a ball-room chandelier in an old-fashioned cottage, or make other mistakes similar to that of the New Guinea chief who, having had a shirt given him for himself and a dress for his wife, put on both her garment and his own, and, with the addition of his usual barbaric ornaments, headed a procession of his warriors with splendid pride!

In the matter of design we make errors of taste exactly equivalent to these, though our sins against art escape general reprobation; in the first place, because everything that is made, being decorated somehow, the decoration is taken as a matter-of-course, and hardly noticed; and in the second place, because of those who do notice, very few have enough knowledge of what decoration should be to criticise.

The fact is, we live in an age of chaos, when the very abundance and variety of our materials prove our greatest difficulty. The decorated products of every foreign country are now poured in upon us, and we possess the art work of all past ages and schools, while we are without any living traditions to guide us in forming a nineteenth century school of design.

What we need is a definite knowledge of the subject—a knowledge not to be learnt from any one book, or indeed completely from any collection of books, but which must be acquired by patient and accurate individual study.

In architecture, where in modern days great confusion of styles and ignorant jumbling of disproportionate parts have been painfully prevalent, there is now a growing enlightenment. We have hold of the important principle that harmony of style is a first essential in a work of art, and that no beauty in the detached parts will compensate for a want of unity in the whole. It is this principle that we have to establish as a basis of practical work in all applications of decoration.

Just as a knowledge of the different styles of architecture belonging to other ages and other countries is needful for the architect before he begins to start on original work of his own, so before we attempt to produce original design we should make ourselves familiar with the decorative work of past periods and foreign lands. We must be able to classify, adapt, and arrange before we can make use of the heterogeneous mass of design which we find ready to our hands.

It is extremely interesting to trace out the first beginnings of design as they are found among savage nations in different parts of the world. The rudimentary efforts at artistic production generally consist in rough attempts at carving human heads to serve as idols or fetishes, and a simple form of surface decoration. This surface decoration is done in flat painting, generally red and black on a white ground, or more rarely by some process of burning on wood, or in the scratching of lines and dots. We may suppose that the first decoration of the third description was the tattooing of the artist's own person, and that, struck by the beauty of the result, he extended the process to his canoes, weapons, and domestic implements. The scratching, as it grows more skilful, and as the tools used for the process improve, becomes a system of elaborate etching and incising. The lines and dots, symmetrically repeated and adapted to cover a given space, are the simplest form of design—pattern-drawing. The space covered is almost invariably the whole of the decorated object, redundancy of ornament being the savage's chief idea of beauty, a point where he and his over-civilised brother, like most extremes, meet. A surface completely covered with a minute pattern repeated a thousandfold would be the barbaric notion of the perfection of decorative art.

When we speak of savage nations, however, it must be remembered that, in spite of certain features in common which enable us to generalise respecting them, the artistic gift is very differently developed in different races.

In the Nicobar and Andaman Islands, for instance, the attempts at decoration consist of rude smearing in some kind of mud on a light ground (Fig. 1) and painting of the roughest description (Fig. 2): the single idea in the way of design possessed by the inhabitants seeming to be the zigzag, this idea being most imperfectly carried out. The natives of the Fiji Islands, on the other hand, produce designs not lacking in actual beauty, and very accurately drawn and coloured (Fig. 3).

But little of the artistic instinct seems inherent in the African races. The pottery made in Northern Africa is painted in the rudest geometrical designs, so far from accurately that it is evident the decorators never learnt the art of ruling a line. In the work of Madagascar there are good bits of design, but a lack of idea in combining them. The West Africans, though some of their work in coloured leathers is rather pretty, show but little skill in pattern-drawing; while in the eastern part of Central Africa the decoration is of the roughest, and the designs are, as ornament, meaningless and very poor.

The same sort of apparently meaningless designs—an attempt at pattern-drawing without the perception of what forms the beauty of this species of art—symmetrical repetition—is remarkable in the painted bowls which come from Peru. But there is a curious glimmering of the Greek idea in the specimen sketched in Fig. 4. In Guiana, which is not far from Peru, the severe charm of the Greek borderings is almost reached in the patterns employed for the native basket-work (Fig. 5).

It is interesting to detect here and there the rudiments of some form which has been developed by civilised art into designs of rare beauty and intricacy. In Mexico we come across a simple guilloche (Fig. 6). In Katchyen, in Assam, we find a rude representation of the "vine" pattern, so universal in European work (Fig. 7). The curves are certainly execrable, in curious contrast with the delicacy and correctness of the etched pattern decoration from the same place, but there is an effort at the representation of growth.

According to one great authority on all that concerns savage races, every design had its origin in the copying of some natural form, though, through want of skill or constant repetition, all trace of the original may be lost. A very close and beautiful representation of the leafy stem is to be seen in some flat painting on a papery material from the Samoan Islands (Fig. 8). In Borneo and other islands of the Malay Archipelago which have no doubt come in contact with the art of the Eastern world the designs are of a high order (Fig. 9).

Perhaps the most beautiful of all savage design is that of the natives of New Zealand. While the work of the Australians is of the roughest and most meagre type, the carving of the New Zealanders is singularly advanced, and their incised patterns are lovely. There is one idea on which the best of them are founded—an idea which enters largely into the composition of Celtic work—the inverted volute. This is worked out into a variety of beautiful designs, gracefully adapted to the surfaces they are intended to cover (Fig. 10). The same form appears in the work of New Guinea, but less skilfully used, and without the same variety (Fig. 11). It is where a single form is thus produced in a variety of sizes, proportions, and positions that we have savage decoration at its best and in its most characteristic form.

The natives of the Friendly Islands have, like the New Zealanders, taken one idea, and theirs is the most primitive imaginable—namely, the zigzag. From this single form they produce surprisingly varied effects, and cover large spaces without any suggestion of monotony. The Solomon Islanders have also taken the zigzag, and with it again produce fresh varieties of pattern (Fig. 12).

The work of the North American Indians consists chiefly in the pictorial representations of natural forms, flowers and beasts, men and women. These are worked on birch bark in moose-hair, dyed the most brilliant colours, each hair forming a single stitch (Fig. 13). Their figures and flowers are more quaint than beautiful, but the decoration of their mocassins with bright-toned cloth worked in beads, and contrasting with the yellow leather, is very picturesque.

In the Ethnographical Gallery of the British Museum—a rich store-house of the work of savage peoples, where the student of barbaric art may spend many profitable hours—perhaps the most striking artistic efforts are those of the Arctic Americans (Fig. 19). There is a delightful grotesqueness in the odd beasts and birds painted on their flat wooden spoons, and the scenes from Arctic daily life, delicately etched on weapons and implements used for obtaining a light, are worthy of study. They are admirably drawn, and there is an immense deal of spirit in the little people, with black lines for legs and arms, engaged in building wigwams, spearing seals, rowing ark-like boats, and catching whales. Evidently, the dwellers in these frozen regions are a people endowed with the artistic instinct, and that even rarer gift, a sense of humour. Fig. 14 is a bit of rough incising by Paraguay Indians. Figs. 15, 16, and 17, ornaments on drum from Saibai Islands, Torres Straits. Fig. 18, S. African bird.

Patterns of the kind produced by savage art are applicable to all sorts of work in which a large surface is to be covered, and should—as in table-tops and stools—be kept flat. Some of the designs given might be

used for wood-incising, some for tiles, some for poker work, and others for embroidery. The border on the heading of the paper, for instance, might, enlarged, be worked in silks to form the border to a table-cloth, each line being represented by a stitch.

A NEW MARKING GAUGE.

BY PERCY C. RUSHEN.

As all mechanics know, or ought to know, the great secret in working wood or metal is to have the setting-out tools perfectly correct—and I sincerely hope that the gauge I am about to describe will go a long way towards assisting the setting out of work properly, and that you, reader, whoever you be, will set the example in your select clique by making and using one.

Here is a good idea, and one which I have never seen before. Fig. 1 is a side elevation, partly in section, taken on the line A in the figure of the improved gauge; and Fig. 2 is a plan of the same.

The stock and barrel are, as usual, made out of beech in the ordinary way, the barrel either having a fixing screw or wedges to fix it in its adjusted position on the stock. I have represented a fixing screw, as I think it is preferable and "real English." But instead of fixing the scriver a short distance from the end as usual, it is fixed at the extreme top. As seen in the drawing, it is a blade scriver, fixed by means of the countersunk wood screw, *a*. Or the screw may be screwed into an iron screw pummel, or box, or nut fixed in the end of the stock; but as the scriver is moved but rarely, I think a wood screw would suffice. By means of this screw working in slot *b*, the depth of the projecting part of the scriver (which marks or cuts the wood) is adjusted. The scriver consists of a small plate (*c*) of the size shown, either of iron or mild steel, afterwards hardened to a dark straw colour. It works in a slot cut in the head of the wooden stock. It is ground off from the inside of the stock, and may be either semi-elliptical or semi-circular in plan. When finished, the edge of the scriver which cuts the wood ought to be perfectly flush with the rest of the end of the stock, no parts projecting further than this point, but perfectly at right angles thereto.

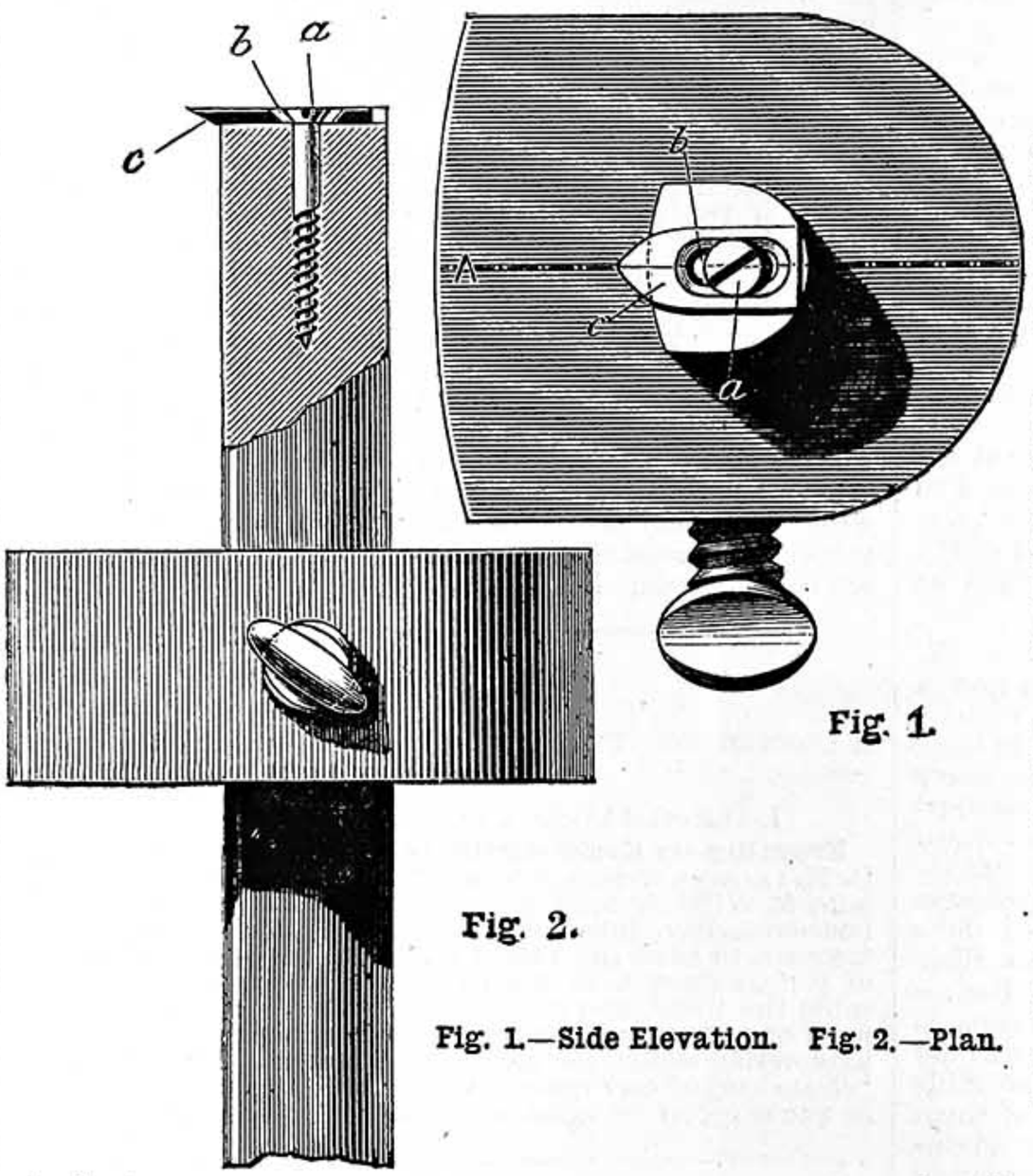


Fig. 1.

Fig. 2.

Fig. 1.—Side Elevation. Fig. 2.—Plan.

Its advantages are numerous; among others being that:—

1. It measures rebates and varieties of sunken parts perfectly.

2. It is of great use in circular saw benches, small planing machines—in fact, any kind of rotary or fixed cutter machine—for measuring from the fence or guide to the tool.

3. It may be held in position while a tool (*e.g.*, chisel) is placed against the end, and is driven without loss of time. Nails and screws may also be held there while being partly driven home. A pencil may be placed there to mark instead of the scriver (which may be fixed back) for those who prefer pencil lines for rough work.

Those who have seen and tried the tool speak well of it, and it is presented here for the benefit of all readers of WORK who may care to make one. Should any difficulty arise in the process I will answer through "Shop."

EMIGRANT FIELDS AND PROSPECTS.

MANITOBA.—Advantages—Farming—Railway Lands—Prospects.

FOLLOWING the information given by our Ottawa correspondent in No. 159, we have now the pleasure to print the personal testimony of one who can speak authoritatively upon Manitoba as an emigration field. Having spent many years in the Manitoba country, **D. B. C.** writes:—

It may be asked, "What advantage would there be in a man's exchanging work in England for work in Manitoba?" The chief advantage would be that he would lead a healthy life in the open air instead of being cramped up in an office. He would be more independent, and his chances of having a comfortable home within a reasonable time would be greater. If he went out during the summer, he would have no difficulty in getting work on some good farm at once. At first he would be paid from two to three pounds a month and his board and lodging; how much more he got than that would depend upon how useful he made himself. He would have to work hard—at first he would probably think too hard. By working for good farmers he would get a practical knowledge of farming not to be got in any other way, and, if he saved his wages, he should, in a few years, be in a position to take up land of his own (160 acres can be had on payment of a small fee). To get free land he would have to go a long way from the markets, as it is all taken up near to the railways and towns. The railway companies have a large amount of land that has been granted to them to induce them to extend their lines into unsettled districts. This land they generally will sell to settlers very cheaply, and at very reasonable terms of payment. Our young man would have to build himself a house and stable, and would want some farm implements, a pair of oxen, and some seed grain to start with. By only putting in a small crop the first year, he would have time to do some work for his neighbour with his oxen, and so get money to pay his current expenses until he sold his crop. If his first crop were a failure, he would have to work out again part of the next year. Anywhere in Manitoba the land is bound to increase in value as the country gets settled, and our young man, after a few years of economy and hard work, would find himself the proud possessor of a valuable farm, and his own master. I do not say that to get a farm in this way would be easy. The towns of the West are full of young Englishmen who have given up farming in disgust after a short trial, many of whom have had every advantage to start with; but, on the other hand, you constantly meet with prosperous farmers who started as farm labourers without capital. The climate of Manitoba is one of the most healthy in the world. The winters are cold, but the air is very dry, and cold that would be unbearable in our damp England is there bracing and not unpleasant. The Canadians are splendidly hospitable, and are always ready to lend a helping hand to strangers who they see are willing to work. My remarks apply chiefly to unskilled labour, in which class I include especially young men without capital who have not learned a trade or profession, and who, if they stayed in England, would have to take a clerkship in an office or shop, without much prospect of ever earning more than a bare living at that most dreary of occupations unless they have great ability or influence.

SCIENCE TO DATE.

Nitride of Lithium.—Quite recently we noted that nitrides of the alkaline earths and magnesium had been prepared. Lithium must now be added to the small number of elements which combine with nitrogen. Lithium nitride has been recently obtained by M. Ouvrard as a black spongy mass.

Aluminium Hydrate from Clay.—A simple process has been invented by Meyer, of Berlin, for preparing aluminium hydrate direct from clay. It consists in bringing superheated steam in contact with finely divided clay, dissolving the hydrates formed, and obtaining the aluminium hydrate from the solution by precipitation. This should be available for the cheaper production of aluminium.

The Camphor Tree in Florida.—Some time ago the camphor tree was introduced into Florida. The experiment has proved completely successful. The tree flourishes vigorously.

The "Aluminium" Light.—Magnesium ribbon is often burnt when a very intense light is required for photographic or medical purposes. M. Villon has found that aluminium may be utilised instead by burning it in a spirit lamp or, if a flame of greater brilliancy is required, in coal gas. Aluminium burns without emitting fumes, and is also cheaper than magnesium.

Saltpetre in East Africa.—Dr. Peters has discovered great deposits of saltpetre in the Kilima Njaro district, and near the Donjongai volcano there lie great swamps, from which soda is obtained. It is expected that German East Africa will compete successfully with Chili as regards the exportation of nitre.

NOTES FOR WORKERS.

THE poor in Germany live chiefly on rye-bread, but in consequence of the famine in Russia, whence most of the rye is imported, rye has gone up greatly in price. It has been found that by mixing maize-flour with rye-flour a very good and cheaper bread can be made. It is called "Murphy bread," after its maker.

THE entire tobacco crop in the United States amounted in 1889 to 488,255,896 lbs., the number of planters being 205,862, and the area devoted to tobacco culture being 692,990 acres. The average production per acre of the entire country was 705 lbs.

THE Sims-Edison torpedo has the power to dive under and cut through obstructions placed in its path, and can be steered from the vessel from which it has been launched.

A NEW star suddenly appeared in the constellation Auriga, in the Milky Way, at the end of January. The discoverer sent an anonymous postcard, announcing the fact, to the Royal Observatory, Greenwich, and, a search being made on February 1st, the anonymous announcement was found to be correct.

TRADE: PRESENT AND FUTURE.

*** *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

TIMBER TRADE.—Dock deliveries show a further falling off over the corresponding period last year. Prices all round are very meagre, a large portion of goods having lately been sold at a price under the cost of import. It is to be hoped that the imports during the coming season will be low, and so give prices an opportunity of recovering themselves. Several vessels have already arrived. The hard wood trade is very quiet, although there is a demand for black walnut of good quality. The teak, mahogany, and fancy woods are just now very flat.

DYEING TRADE.—A dispute has arisen at a Bradford firm, where 600 *employés* have struck work for an increase of wages varying from 1s. to 2s. per week. Upon this, the master dyers of the town gave notice to 6,000 men to cease work unless this firm's hands gave in. A general lock-out seems inevitable.

BUILDING TRADE.—In Manchester and district, the building trade remains very firm and good. Masters and contractors report a promising influx of work in addition to jobs in hand. In Rochdale and district, the strike of bricklayers' labourers is over, the masters having agreed to the advance of ½d. per hour, while the men have withdrawn their demand that one labourer should be allowed to each bricklayer. The building trade section of the Liverpool Trades Council has apparently come to the conclusion that the carpenters and joiners of the district have now a right to demand a revision of an agreement entered into several years ago. Fifty-five hours now constitute the week in this district, and it is suggested that fifty or, if possible, forty-eight should be worked instead, while at the same time it is considered that the pay should be increased from 8d. to 8½d. per hour. The painters in this district are complaining of the action of the masters, who, it is said, employ apprentices as journeymen at apprentices' wages.

COTTON TRADE.—Through the dispute in the Lancashire cotton spinning trade, there is now a stoppage of 90 per cent. of the mills in the county. Some of the masters having good contracts in hand will continue to run their mills and pay the heavy fine which this course will involve to the Masters' Federation. Three large mills have also been closed in Bolton through bad trade, although cotton manufacturers there are not affiliated with the Manchester and District Masters' Federation. There are indications that others in the town will soon follow their example. Our Manchester correspondent writes:—Unless some very decided action is soon taken, it is not easy to see how a very serious stoppage in the cotton trade is to be avoided. Most of the mills in the Rochdale district are closed, a few of them for a week only, but the greater part for an indefinite period. The Operative Spinners' Association has raised the contributions by an extra levy of 2s. per week, in order to meet the extra drain on the funds through so many of its members being locked out.

TIN PLATE TRADE.—The closing of works and the general depression of trade amongst tin plate and galvanised sheet makers has thrown many men out of employment at Wolverhampton and the surrounding district.

ENGINEERING TRADE.—The tendency to increasing slackness in the engineering trades of the Lancashire district continues, and, with few exceptions, the local works are rapidly running short of work. In many cases, hands are being discharged or short time is being worked. Boiler makers, however, still continue fairly busy; indeed, this branch of the trade appears to be decidedly well off for work—actual and prospective. Machine-tool makers continue very short of work, and stationary engine builders are, in most cases, getting decidedly quieter. Machinists have a fair amount of work on hand, but the depressed state of the cotton industry is having the effect of checking new ventures, and the prospects in this branch of the trade are none of the brightest. Locomotive builders still report a decided absence of new work coming forward, but they have still a fair amount of work on hand. From the latest returns of the Amalgamated Society of Engineers it appears that, of the total membership of 7,000, 8½ per cent. are in receipt of out-of-work support, with 2½ to 3 per cent. on the sick list, while a similar proportion are superannuated. In the iron trade, little is being done, but still local makers have lately booked a fair weight of new orders as a consequence of the limited production of other districts. In the Tyne and Wear districts, there are a sufficient number of orders standing over until the engineers' strike is settled that will give the members of the Amalgamated Society of Engineers and their fellow-tradesmen, as well as those of the Boiler Makers' and Iron Shipbuilders' Society, employment, which will last for the remainder of the year. The masters have determined that engineers shall no longer be employed on brass work, but brass finishers.

SILVER CUTLERY AND ELECTRO TRADES.—The Sheffield silver and electro trades are generally dull, with little prospect of improvement. Some good orders have, however, been received by individual firms, including a magnificent candelabrum and centre-piece for the officers' mess of a crack regiment. In best cutlery there is very little business, nearly every market showing signs of stagnation, and the trade in common cutlery is proportionately worse. Ivory and pearl are quoted at high prices, notwithstanding the lessened output for handles of knives and the competition on the part of xylonite manufacturers.

CYCLE TRADE.—The Sheffield business in bicycle sections is greater than ever, great attention being given to pneumatic tires. Belgium has two cycle manufacturers, who hold that their wares are superior to anything imported from Britain. This may be doubted, as the fact remains that this country has done a very large business with Belgium this season.

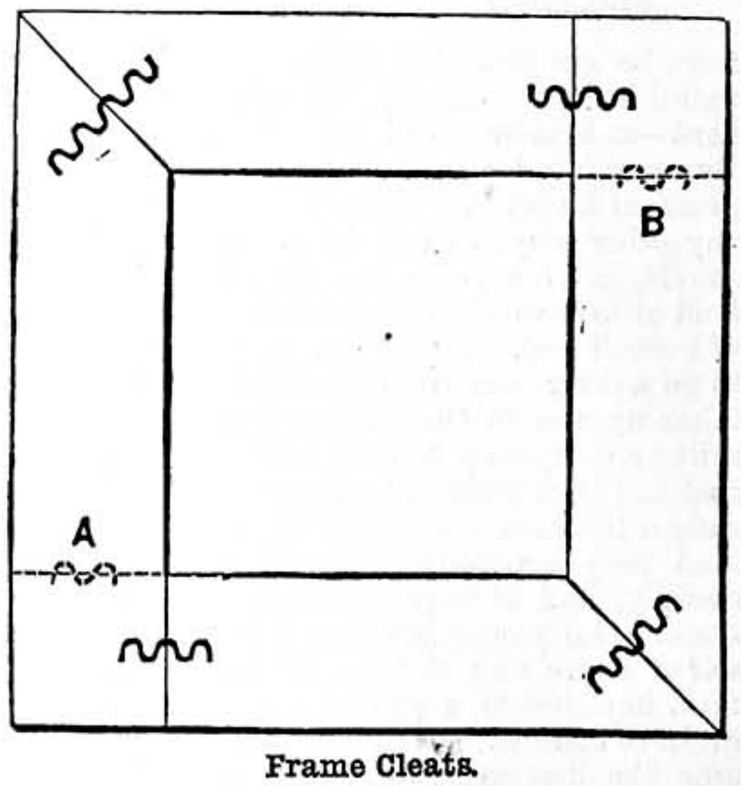
IRON AND STEEL TRADES.—In Sheffield, the producers of Bessemer steel are harassed by the strike in Durham. The coke obtained from that district is all but unobtainable except at high prices, and as this fuel is used almost solely by the makers of Bessemer steel, the effect on the trade may be imagined. Hematites have risen several shillings per ton during the past fortnight. Makers of railway waggon wheels, tires, and axles are full of orders, and, but for the unfortunate stoppage in the North, trade would be prosperous. The stove-grate trade is inactive, but as the builders advance with their many contracts a busy future is anticipated. Makers of agricultural tools and implements are busily employed.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

I.—LETTER FROM A CORRESPONDENT.

Framing by Coach-builders and others.—J. C. K. (*Lisson Grove*) writes:—"Messrs. Whittingham & Wilkins, the large coach-furnishing warehousemen, have introduced a simple 'cleat,' or joint fastener, to save the risk of nailing mitres, etc., as of picture-frames, in the edge, which sometimes splits the wood, and sometimes drives the sliding joint out of true fit, unless bored to allow for the hammering sliding the joint out of position. These 'cleats' are of corrugated steel ribbon, very sharp at one edge, so as to be self-penetrating into hard



Frame Cleats.

wood when driven with a hammer on a solid bearing on the under-side of the frame. Various sizes and lengths to suit various jobs are supplied at a small cost. The illustration given will show their application to mitre or lap joints. The dotted lines at A and B show that extra security of joint may be had by driving in others from the reverse side. In carriage window-frame making, and other light framings, they will be useful, as well as to joiners generally."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Stage Carpentry.—W. H. H. (*New Delph*).—Articles on Stage Carpentry appeared in WORK, Nos. 140, 144, 149, and 154.

Patent.—T. L. (*No Address*).—In reply to question No. 1, no person can legally make any patented article without the licence of the patentee, as this would be an invasion of the patent right and an injury to the patentee. Lord Justice James has laid it down that "The sole right granted by the Crown to make, use, exercise, and vend the invention within the United Kingdom, and the right to have and enjoy the whole profit, benefit, commodity, and advantage accruing and arising by reason of the invention," includes a monopoly of the sale in this country of products made according to the patented process, whether the machine be made in this country or elsewhere. It may be added that the patent, in another part, expressly forbids any person directly or indirectly to make, use, or practise the invention; otherwise it would render the privilege granted by the Crown futile. In reply to question No. 2, a person may, under the new Act, demand a licence from a patentee to work under the patent, and if he demands a price as royalty which is too high, the party wishing to obtain one may apply to the Board of Trade to decide what sum shall be paid. All articles made under a patent must bear the word "Patent," so as to warn the public that it or they is or are made under an exclusive right or privilege, and so give them notice not to infringe.—C. E.

Electro-Plating.—P. L. (*Birmingham*).—In the article on electro-silvering small goods published in No. 112 of WORK, the weights given are troy, but the proportions will be the same if avoirdupois weights are employed. You may employ less silver than 4½ ounces to the gallon, and get good results for a short time; in fact, for silvering small goods with a light deposit of silver, the solution need only contain from one to two ounces of silver in the gallon. A solution thus prepared will cost less, but there is no cheaper method of making a good silver-plating solution than that given in the above-mentioned article. Other methods turn out to be more costly than that given by me.—G. E. B.

Dulcimer.—CAWD-HUD.—The jarring of which you complain may proceed from one or two causes. If you have set your blocks out properly, there ought to be no difficulty in keeping the wires apart, the tension of the strings themselves being sufficient for that purpose. It is as well to avoid notching, or in any way roughening the bridge wires over which the strings pass, as it increases the tendency of the latter to break at that point. If, however, your blocks are so set that the strings *will* get together, notch the bridge wires with a knife edge and a small hammer—a very light blow will suffice for the purpose. The most likely cause of the jarring will probably be found in the fact that the pressure bars are not high enough. You have perhaps made the grooves in which they rest too deep, and consequently the top of the bar is lower than the block itself, so that the strings, instead of taking their bearing *from* the bar, only rest lightly on it. If such is the case, you will be able to move the strings easily up and down, and the remedy consists in putting in a stouter bar, or raising the present one by placing a very narrow slip of stout paper in the groove under it. With reference to your second question, I should not advise you to make an instrument with less than three strings to a note. The dulcimer depends, in a great measure, upon the "sympathetic" notes given off by the strings which are *not* struck, and it is obvious that a reduction in the number of these means a corresponding falling off in the volume of tone. If you strike a single note, and immediately "damp" it by placing the finger on it, you will find you have set into vibration a number of other strings as well, which are, as it were, "joining in chorus," and this will explain what I mean by sympathetic notes. If you still think of making an instrument such as you describe, let me know the dimensions, and I will advise you about stringing.—R. F.

Overhead Motion.—BARBADOS.—The firm of Dell & Co., of Bristol, no longer make lathes. I have a letter from Isaac Dell, in which he says:—"We are not able to undertake the making of the frame for the overhead motion. In the absence of any name, we do not recognise the work indicated on your diagram." I had sent him your drawing, and your signed letter. I should say that the notches at the top of C are intended to catch the pin, D, and so hold up the bar, B, instead of using a weight to tighten the band. The notches in B may perhaps be intended for the neck of a shaft to turn in; I can't imagine what else they can be for. Shaft D is centred, so perhaps it is the one which receives motion from the fly-wheel, and lies right over the mandrel at E, between the tops of the upright standards, A. Then I imagine this shaft, D, might communicate motion to a second overhead shaft, with necks turning in the notches, F, F, in the bar, B, and thus allowing the band between them to be tightened. At G there may be a tie-bar to prevent the screws at E, on which D runs, from thrusting the tops of standards apart.—F. A. M.

Horizontal Engine.—SHOPITE.—Your particular engine of 3⅛ in. by 6 in. is three or four times the power of the ¼ horse-power engine described in WORK, and you may rate it as fully 1 h.-p. You should have a larger governor than the one for the ¼ h.-p. engine, and the one on page 294 of Vol. II. would be about right. You will require a boiler of, say, 22 in. diameter and 44 in. high, with seven vertical tubes, and about 16 square ft. of heating surface. As to your feed-pump, the bent eccentric rod would be a bad plan. I hope you will be able to avoid it by fixing the pump eccentric *outside* the

bearing, and altering the method of fixing the pump, which would be better fixed to the bed-plate that it may not abstract heat from the cylinder. As to the stroke of your pump, if it is *bored out* ⅜ in., it should be 3 in., which will require a large eccentric; but I hope you mean the *cast* hole is ⅜ in., in which case you will bore it out to ½ in., and then the stroke will do 1½ in. I reckon thus: area of $3\frac{3}{8} = 9$, 9×6 in. stroke = 54 cubic in. of cylinder capacity per stroke, or 108 per revolution. Steam at 38 lb. occupies 500 times the space of water, therefore $\frac{108}{500} = \frac{1}{5}$ gives the cubic in. of water to be thrown by each stroke of pump; as pumps throw about two-thirds their theoretical capacity, $\frac{1}{5} \times \frac{2}{3} = \frac{2}{15}$ cubic in. is the actual capacity, and since the area of ½ in. is ·19 square in., and $\frac{\cdot 3}{\cdot 19} = 1{\cdot}5$, 1½ in. is the required stroke of the pump. It would perhaps be more convenient to have it 2 in. for filling up more quickly.—F. A. M.

Ball Bearings. — W. D. (*Calne*). — Ball bearing cups and the fixed cones on axles are put in with tinman's solder. The process is thus: The cup to be fitted into the end of a hub should fit neatly, but easy enough to be pressed in with the hand without hammering. The parts must be thoroughly cleaned, then tinned (both socket and outside of cup) with tinman's solder, using as a flux spirit of salt or resin. Then the cup is entered in the socket, and the flame of a blowpipe applied, when the cup will slide into its place, helped, perhaps, by a little pressure. If it does not appear to sit evenly all round, re-heat, and press the high edge. They should be set truly, otherwise the balls will not run freely. The process is the same for a cone on the driving axle.—A. S. P.

Saddlery. — APPRENTICE TO THE TRADE. — As soon as we can find a thoroughly trained workman capable of writing upon this trade, we shall be prepared to consider a series of articles. —ED.

Staining and Polishing Whitewood.—WHITEWOOD.—You ask, "How can I stain and polish whitewood?" but give no clue as to the colour you require it, or what wood you wish to imitate; a whole column of "Shop" might be devoted to staining alone. If you will write us again, saying definitely what you require, we shall be pleased to help you. On the subject of French Polishing, Vol. III. of WORK abounds in information, both in articles and "Shop." Amongst the former will be found—"The Rubber in French Polishing," "Filling in," "Bodying in," "Spiriting off," etc. You would do well to procure the whole of the numbers, either weekly or monthly. Scarcely a week passes but something appears in its pages in reference to polishing. The process is essentially the same, whether it is whitewood or the more expensive, such as mahogany, rosewood, or walnut.—LIFEBOAT.

Cellulose Paper.—W. D. (*St. Helen's*). —I think some difficulty will be found in obtaining samples of a paper applicable to the various uses mentioned. It will be admitted by persons who have a practical acquaintance with the wood pulp industry that cellulose is being adapted to a very wide range of uses, but some difficulty will probably be found in placing a sheet of paper on the market capable of being applied, without further treatment, as a temporary covering for roofs, for packing of goods, also as a damp-proof wall-paper, as a production suitable for maps, and a material impervious to water, and absolutely fire-proof. These claims for one particular sheet can hardly be regarded as feasible. It is true, however, that wood cellulose (treated by various processes) is being adapted to all kinds of purposes, and that it is an important factor in many of the industrial arts. I should imagine, if the paper in question had any existence at all, that an imitation parchment made from cellulose was meant. These so-called parchments, which are sold under prices obtained for real parchments, are claimed to be grease-proof, and suitable for wrapping and covering purposes generally. Imitation parchments are made at a large number of mills on the Continent and in this country: notably by the Ekman Pulp and Paper Co., Northfleet; Olive & Partington, Glossop; and the Hythe End Paper-mill Co., Staines, Middlesex. The writer recently had under his notice a process (credited to a German firm) for making a non-inflammable paper for lining walls, floors, ceilings, etc. The ingredients recommended were: 40 parts paper pulp, 10 parts alum or sulphate of iron, 10 parts graphite, 25 parts infusorial earth, 15 parts asbestos, 15 parts water glass. The whole is well mixed and passed through a mill. After drying, both sides are covered with water glass.—F. G.

Double Draught Bellows for Portable Forge. —A. E. W. (*Pershore*).—There are many kinds of double draught bellows, but the one I shall describe is perhaps the simplest to use with the forge described in WORK, Vol. III., No. 149, pages 705 and 706. The accompanying drawings will, I hope, make the arrangement quite clear to you. Fig. 1 shows the bellows in section. In this case there are four round boards, A, B, C, and D. The two boards B and D are fixed, and the boards A and C move up and down, the links from the cranks and handle being attached to the board C, in the same way as they are attached to the centre board of the bellows described in connection with the portable forge. The action is as follows: On lowering the handle, the board C will rise, driving the air before it through the valve H^1 into the top compartment, at the same time drawing the air through the valve H^3 into the lower compartment. On raising the handle, the board C will fall, forcing the air down through the wood block E up the pipe F, and through the valve H^4 into the top compartment, at the same time drawing the air through the valve H^2 into the middle compartment. This action is repeated at each either upward or downward movement of the handle. This will force the air through the outlet G in an almost continuous stream. What jerks or irregularities there may be in the flow will be remedied by the rising and falling of the top board A. The bellows are fitted up as described in the article on a Portable Forge, and I think A. E. W. will now have no difficulty in constructing it.—CYCLOPS.

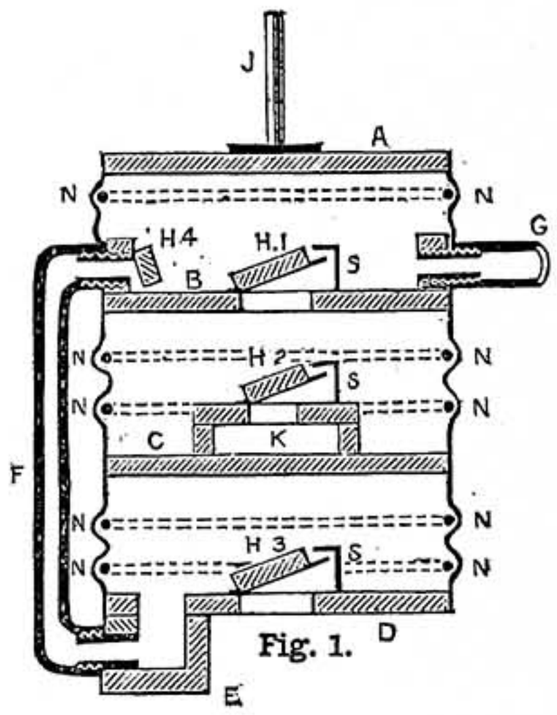


Fig. 1.

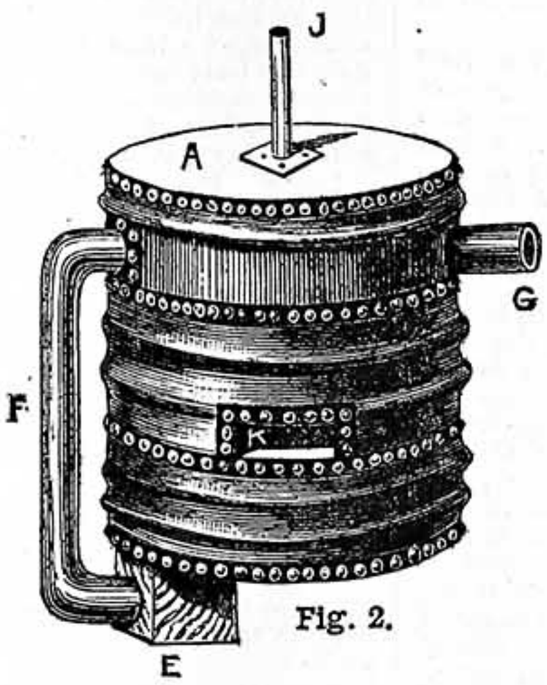


Fig. 2.

Double Draught Bellows. Fig. 1.—Section showing Valves, Tubes, etc. Fig. 2.—General View of Bellows.

Semicircular Sash.—STOKE.—There are three or more ways in which a semicircular head or top rail to a sash can be joined. (1) The segments can have a butt joint, with one or two dowels to prevent lateral movement and a handrail screw to draw the parts together. This is good for hard wood sashes. (2) The segments can have a central chase or groove with a tongue of *hard wood* inserted. This tongue can be made "hammer-head" at both ends, like a capital H (see Fig. 3), with an extra long bar to join the uprights. This is good for deal sashes. (3) The top rail can be built up of thin segments, arranged so as to "break-joint," glued and screwed together, and the moulding bent to shape, and fixed after the built-up rail has been properly cleaned off. This would be appropriate if only a small part of the vertical surface is exposed or when the sash is of deal, veneered. There are, doubtless, other ways than these, but these will suffice. As to the scale drawing, of course 1 in. to the foot is not the same as 1 ft. to the inch. In both cases it is left to the reader to supply the missing words. It would be correct to say the drawing is 1 in. to the foot, and it would be understood that the "foot" refers to the object, which object, of course, would be 1 ft. to the inch. As to the marks, ', ", they were formerly intended to indicate minutes and seconds of *arc*, but they have often been wrongly used to indicate minutes and seconds of *time*, and they have been now wrested from their true meaning to express feet and inches, which is to be regretted, but it is too late now to resist.—B. A. B.

Fig. 3.

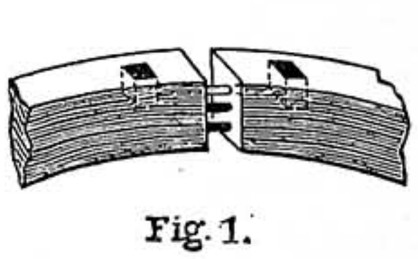


Fig. 1.

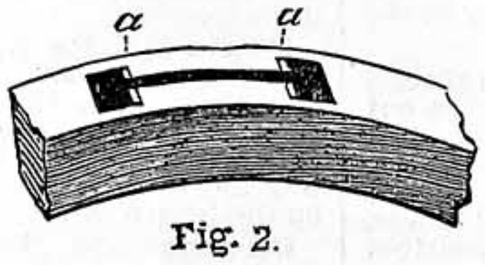


Fig. 2.

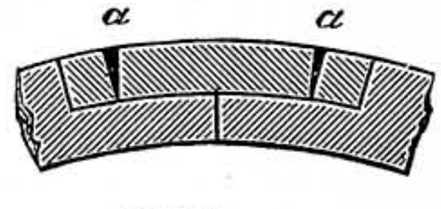


Fig. 4.

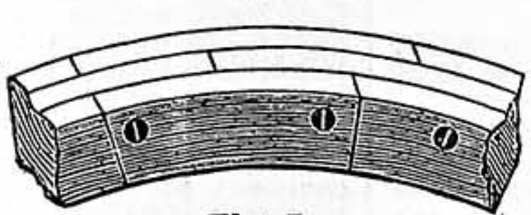


Fig. 5.

Semicircular Sash. Fig. 1.—Joint made with Handrail Screw and Dowels. Fig. 2.—Butt Joint, with Hammer-head Tongue; Wedges may be inserted at *a*, *a*, if required. Fig. 3.—Plan of Hammer-head Tongue, to be made of hard wood. Fig. 4.—Section of Fig. 2—*a*, *a*, Spaces for Wedges. Fig. 5.—Top Rail built up in Segments.

Profitable Home Work.—A. M. (*Hastings*).—With no information as to what your capabilities may be, it is impossible to give you any satisfactory answer. *Profitable* employment is only to be had by those who have the special skill required to produce something which is in demand. Unskilled labour—the work which anybody can do—must always, as a rule, be poorly paid. As an evening fireside occupation, some persons within the range of my acquaintance have worked at netting. Anyone of ordinary intelligence can learn to net in an hour; shuttles and meshes are easily made, or may be bought for a few coppers; and there is always a demand for garden nets, fishing nets, tennis nets, etc. For such simple work, however, high pay is out of the question. Still, if you have not the skill to do better, the hint may be of use to you.—A. Y.

Rearer.—T. R. M. (*Wallsend*).—The address of Messrs. Winchcombe is Leonard Stanley, Gloucestershire; and the price of the small rearer is 6s. 6d.—LEGHORN.

Oil Gold Size.—BONÂ FIDE.—This is another painters' product which, although—like varnish making—easily understood, can seldom be prepared with economy and success by the individual. The quality of good *oil* gold size lies in its being easily workable, drying in about twelve hours, and keeping its "tack"—the scarcely perceptible stickiness of surface, but which is ample for retaining the delicate gold leaf—for some days, and its brilliancy always. It consists of "fat" linseed oil, usually termed "fat oil," which becomes so by age and exposure to atmosphere. Fat oil is also prepared artificially—by heat. This fat oil is the chief factor; it gives us something that will dry, that can be spread to a very thin coating, and yet give much gloss, and at the same time be "tacky" when varnish would be quite dry. To give it a little more body, and to colour it for manipulating purposes, the finest yellow ochre is ground with it. The two form a stiff paste. The value and quality of the product depend much on the fineness of the grinding. It is then thinned for use with either fat oil, boiled oil, or finest copal varnish, or even all three, according to the time it is wanted to dry in and keep its "tack." These points have to be tested before the size is given out for direct use. Many eminent varnish-makers send out an oil gold size thinned to a liquid form, and ready for use. That made and sold by the well-known Mander Bros. is a splendid article, and it would be far wiser to purchase this from them than to buy the paste and dilute it yourself, with the chance of getting on the wrong tack altogether. As to making it—don't; rather thank your stars you do not live in the days of "mullar and stone" colour grinding.—DECORATOR.

Gold Picture Frames.—C. W. (*Openshaw*).—(1) Mastic varnish is the best, if used in the following manner: Lay your frames flat on a table in a room where no dust can possibly get at them. See that no particle of dust is in the crevices of the ornament, then go carefully over them with a good camel-hair brush, care being taken to spread it evenly, and not to go over the same parts more than once or twice. Let them lay so that it does not run. They will wash, and preserve their brilliancy for years. (2) To repair damage, use white of an egg on parts where gold has come off, or a little gelatine. When nearly dry, lay gold-leaf, and press on with wool until it sticks. When dry, rub off with wool superfluous gold, and varnish with other parts, which will make it smooth with other parts. (3) To clean oil paintings, boil a leek in two gallons of water. When cool, wash paintings well in it, and rub dry with soft silk cloth. When dry, rub a little boiled oil in with the palm of your hand, as you can feel any grit there may be: which remove, in case of scratching paintings. You will find oil restore colour to its former hue, and prevent, in a great measure, cracking.—G. H. R.

Medical Coil Core.—W. T. K. (*Darwen*).—Some makers of medical coils employ a core of rolled soft iron, but the cores in general use for all coils are made of soft iron wires bound up in the form of a round bundle. Steel would be altogether unsuitable, because it would become permanently magnetic, and hard iron is open to the same objection. The best inductive effects are obtained from the core of a coil when it can be readily magnetised, and as readily deprived of the magnetic charge. I know of no book on this subject. You will find something about it in the last chapter of the series on Coils appearing in WORK.—G. E. B.

Hot-Air Engine.—W. L. P.—You cannot make a Robinson hot-air engine, as it is patented. If you want to make one, I advise you to make a small one on the Seal pattern first, and experiment with that. I have made a working drawing of one of that kind, with an 8 in. working cylinder; but as this engine

has never been made, I cannot feel certain it would work well, otherwise I would have submitted it to the Editor before this; but I should not like to have anyone go to the expense and trouble of making the engine, and then, finding it needed alterations, be able to say that WORK had misled them. The main dimensions are: cylinder, 8 in. diameter, 8 in. stroke; heater cylinder, 24 in. diameter; stroke of displacer, 3½ in.; depth of displacer, 12 in.; crank-shaft 1¼ in., and 1 in. necks. Flame plays upon the bottom plate of heater, which is renewable.—F. A. M.

Quarter Horse-Power Steam Engine.—LIMITED MEANS.—Articles on the above appeared in WORK, Nos. 106, 110, 121, 125, 131, 136, 141, 145, and 149.

Xylonite.—TIP and other correspondents ask for the address of H. B. (*Leeds*), who sells xylonite in small quantities. H. B. should keep his address in our "Sale and Exchange" column.

Working Model.—C. H. W. (*Erith*).—You had better begin utilising your clockwork wheels and springs yourself, and see how far you can produce the "up and down motion" model yourself. When you come to a real difficulty, then write again. Tax your own powers a little first, and reason things out for yourself. Then some day you may be able to invent; but don't expect to borrow other people's brains in a too wholesale way.

Photo Materials.—A. B. (*Blackburn*) had better purchase a set of good quality rather than the low-priced articles, whose only recommendation is the small cost. With a *good* set, which need *not* be expensive, there is freedom from many troubles engendered by badly-made work. We should advise the purchase of a half-plate set of as good quality as convenient to purchase. Of the lower-priced goods, Lancaster's are as good as any, and procurable from any dealer, or direct from Lancaster, Birmingham. A good single lens and a good rectilinear should be included in the set. We suggest half-plate size in preference to quarter-plate, as the pictures taken on half-plates look so much better for everything except lantern slides, and give more satisfaction generally; also, by getting used to working half-plates it is much more easy to work larger sizes, if required, than if the attention had been given to quarter-plates. The cost of the complete set need not exceed £6 or £7; the principal outlay is in the lenses. By using cheap lenses—which we certainly do not recommend—the cost may be much reduced.—D.

Revolving Photo Album.—T. W. (*Glasgow*).—The revolving album consists of a box with glass top and bottom, divided into four cells, and of a suitable size to contain the photographs, whether cabinets or cartes-de-visite. The division running from side to side between the top and bottom has a space left sufficiently large for the cards to slip through one at a time. Sometimes small frames are provided to each contain a card, or two back to back. This case revolves between uprights fixed on a stand, and the motion accelerated by a little shake, causing the top cards to slip to the bottom cells, to be in turn covered with those next in rotation. The cards must only be placed loosely in the case, and be quite flat.—D.

Castings of ⅛ to ¾ Horizontal Engine.—READER.—The ¼ horse power engine will give out ⅓ horse-power, but if that is not sufficient, and you wish for a still larger size, you might try Messrs. Lucas & Davis, Charles Street, Hatton Garden, London; or Gladstone & Co., Riddings, Alfreton, Derbyshire; or E. S. Hindley, Bourton, Dorset.—F. A. M.

Greenhouse Construction.—D. T. (*Liverpool*).—These articles appeared in Nos. 12, 14, and 15 of WORK.

Experimental Physics.—C. H. (*Ipswich*) asks for the name of a work on the above subject which also describes the mode of making the apparatus employed. Undoubtedly, the best work which fulfils these conditions is Weinhold's "Experimental Physics," theoretical and practical, containing directions for making physical apparatus and for making experiments. This is a work of some eight hundred pages, and is illustrated with over four hundred cuts. Published by Longmans & Co., Paternoster Row, London; price 31s. 6d.—C. A. P.

Electric Belts.—CRIPPLED.—For an electric belt, consult the advertisers in WORK; or Mr. Atkinson, surgical mechanician, Mill Street, Hanover Square, W.

III.—QUESTIONS SUBMITTED TO READERS.

**** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

Water-Wheel.—W. S. (*Leeds*) writes:—"I wish to make a small turbine water-wheel. Can any reader help me with patterns, etc.?"

Model Locomotive.—E. W. L. (*Newcastle-on-Tyne*) writes:—"Will any reader kindly give me the names of most suitable books on model locomotive building?"

Knee-hole Desk.—H. L. (*Oxford*) writes:—"Will some reader of WORK please tell me where I can get working drawings of a knee-hole desk, and their probable cost, or instructions as to putting it together? The desk to be made of pine or American white wood. The size of top to be about 1 ft. 10 in. wide by 3 ft. 6 in. long."

Clock Case.—CLOCK writes:—"Would some reader of WORK give me a design in 'Shop' for a small clock case in walnut and ebony for a small lever clock—dial, 4 in. in diameter?"

Fish-Frying Fittings.—C. W. (*London*) asks "How to make and fit up a fish-frying and potato copper, as used in the fried fish trade."

Waggon Brakes.—INCLINE BRAKESMAN writes:—"Would any reader kindly inform me of any appliance to slip between brake-block and wheel of waggon during wet weather (on an incline) to work with more safety?"

Model Screw Steamship.—A. B. (*Leith*) writes:—"Would any reader kindly inform me as to the making of a model screw steamship, say, 30 in. long? I should like to know the depth and width, and if two or three propellers are the best; also what kind of wood to build it with."

Upholstering Cheap Furniture.—J. E. B. (*Epworth*) writes:—"Will some reader kindly inform me how to do the above? I cannot get the buttoning to look like the factory-made furniture. Are the buttons put in before the leather is finally tucked down—the way the leather is creased in couches, etc., gives me that impression? I never can get my buttons deep enough."

Long Boots.—V. L. (*St. Leonards-on-Sea*) writes:—"A pair of riding boots are rather too long in the toes, which are blocked, but without caps. Can they be easily shortened, and how?"

Rand Drill.—J. J. T. (*Liverpool*) will thank any reader for the English address of the American rock drill called the 'Rand.'"

Composition.—F. M. (*London*) writes:—"Would some kind reader inform me how I can make a composition suitable for making small bagatelle balls?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Rock Boring Drills.—M. (*Bishop Auckland*) writes to MONT CENIS (see No. 151, page 750):—"There is a very good hand-power machine for rock boring made by R. Wilson & Sons, Bishop Auckland."

Venetian Blinds and Glass Mending.—M. (*Bishop Auckland*) writes to H. R. (*Chacewater*) (see No. 151, page 750):—"A good cement for glass and china is made by a saturated solution of isinglass in pyroligneous acid. Venetian blinds are made by A. Lewis & Co., St. George's Road, Peckham. They would supply you with the laths."

Damp Ceiling.—G. A. H. (*Leeds*) writes to J. W. S. (*Guernsey*) (see No. 158, page 30):—"I can recommend to his notice a paint called 'Vanguard,' which is effectual in resisting the damp from protruding, once it is applied. It dries rapidly, and after it is once dry the ceiling or wall can be whitened or papered. I have seen it applied to a damp wall, and the result is grand. It closes the pores of brick, slate, wood, and stone work, keeping it dry, sweet, clean, and making it last much longer."

Glass Blowing.—E. M. K. & Co. (*Mountjoy Place, Dublin*) write to GLASS BLOWER that they are manufacturers of scientific glass instruments, and carry out inventions of all kinds for scientific glass blowing.

Single Needle Instrument and Battery.—T. B., JR. (*Brooks's Bar*) writes to TELEGRAPHIST (see No. 155, page 814):—"You would find the ordinary Leclanché battery the best for your purpose, as it requires so little attention. It is much cheaper to buy the cells you require, the number depending on the length of your wire."

Oil Light.—M. (*Bishop Auckland*) writes to G. C. (*Pendleton*) (see No. 154, page 798):—"The Wells light is made in various sizes by A. C. Wells & Co., 105, Midland Road, St. Pancras. If you write them, you will get all particulars."

Glass Cement.—EDDIFRA writes to A. S. (*No Address*) (see No. 154, page 798):—"Try indiarubber cement made to the following recipe: 1 part indiarubber, 3 parts mastic, 50 parts chloroform. Let it stand several days at a low temperature to dissolve the cement. It must be applied rapidly."

Lettering Coffin Plates.—H. A. W. (*Holt*) writes to H. E. L. (*Stockton*) (see No. 155, page 814):—"I do a great many in my business, and find the best way is as follows: Write on the plate in pencil what you require; then fill in with sable-writer dipped in gold size, and then sprinkle over it gold bronze powder with camel-hair brush, when you will find it will stick to the size, and form the letters already painted on the plate."

Engraving on Brass and Metal.—W. J. B. (*Londonderry*) writes, in reply to NELSON (see Vol. III., No. 150, p. 733, of WORK):—"A piece of 12 or 14 wire gauge brass—the size required for plate—is first procured; on this the design or inscription is drawn in ink. The plate is then firmly screwed down on a block of wood about 4 in. or 5 in. thick, and the letters chipped out with a steel chisel. After the letters are properly chipped, the plate is unscrewed from the block and planished on an anvil, and afterwards filed perfectly level with a large smooth file. Lines are then drawn at bottom and top of letters, after which the plate is placed on an engraver's sand-bag and finished—*i.e.*, the letters made regular with a large-size square graver. The plate is now heated over a gas-jet, and engravers' wax rubbed into letters. This wax is drawn off with a heated iron—a plane-iron will answer the purpose. When the plate is cool, the superfluous wax is removed with water and pumice-stone, after which emery paper may be used to give the brass a grain. Final buffing materials are rottenstone and sweet oil. Brass coffin plates are riggled—*i.e.*, a lozenge graver, rubbed down on the face to the necessary breadth, is held to the plate at a slight angle, and gently pushed forward, accompanied by a rocking motion of the hand. There are many other branches of engraving on metal, but I apprehend brass engraving is what NELSON wishes to know about. Some particularly interesting and lucid papers appeared in WORK a good while back on Heraldic and Inscription Engraving; I should advise NELSON to procure the back numbers and read them. Many professional engravers have been greatly benefited by them. I am sorry to say good writing is not of much service to an engraver; many crack engravers, like literary celebrities, are but indifferent writers."

Lantern.—CAROLUS REX writes, in reply to E. H. L. (*Leicester*) (see WORK, No. 157):—"What you want is what is known as a 'light box.' Roughly speaking, it is a cheap and ready magic-lantern, but without the objective. It is used to produce the so-called limelight of the stage. It consists of a box, in the front of which is a condenser, and the usual way to throw colours is to employ a disc divided into four sections, each of which is a different coloured glass—red, blue, etc. By revolving this disc slowly before the condenser, the gradations of colour may be made. Purple, for instance, is produced by having half red and half blue before the light. It will be useless to try any other method of illumination than the oxy-calcium or some such powerful light. Get any lantern catalogue; you will find it illustrated."

Brass Polish.—CAROLUS REX writes, in reply to QUILL-DRIVER (see WORK, No. 157):—"Your brass goods were presumably old stock, which your ironmonger had been 'cleaning'; in doing so he had removed all the lacquer—that's all. Your embossed portions you must remove, as they will require to be treated in a weak acid bath. Then dry with sawdust after washing, and apply *cold* lacquer with a flat camel-hair brush. Both lacquer and brush can be had at any drysalter's. Any parts not embossed clean with any good brass polish or Monkey soap, and afterwards lacquer. Never mind if the lacquer looks milky when applied, so long as you don't go over the same part twice; hold the articles near the fire, and the milkiness will disappear. When lacquered, your brasses ought not to require any cleaning—or, at any rate, not for a very long time, when the cleaning and re-lacquering should go together."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—E. P. B. (*Penge*); H. P. (*Langley*); C. C. Y. (*Glasgow*); R. R. T. (*Frome*); A. H. (*Thrapston*); A. B. (*Newry*); F. W. H. (*Weedon*); J. B. (*Crawfordsburn*); W. S. (*Inverness*); A. E. K. (*Aston*); E. D. (*Krugersdorp, S. Africa*); SPOT; MICRO: R. S. H. W. (*High Wycombe*); F. J. G. (*East Molesey*); J. D. (*London*); W. H. (*Plaistow*); TIGER; J. R. (*Glasgow*); T. E. W. & SONS (*Birmingham*); W. F. P. (*Chalk Farm*); G. P. (*Sheffield*); S. M. L. (*Goderich, Canada*); P. C. R. (*Clapham*); A. W. G. (*Jersey*); P. J. (*Mountain Park*); J. M. P. (*Nottingham*); R. P. (*Paris*); J. H. (*Newton Moor*); W. P. (*Dartford*); C. G. M. (*Penistone*); R. D. (*Lewisham*); A. I. J. (*Tipton*); NEW READER; W. A. (*Kentish Town*); OLD MAN; J. A. (*Smallheath*); W. B. (*Queensbury*); J. D. B. (*Ilkeston*); CLAUDON; CARDIFF BOY; S. L. (*Chipping Norton*); SAINT MUNGO; C. S. (*Derby*); PERPLEXED; W. E. L. (*London*); READER OF "WORK"; W. E. C. (*Londonderry*); W. F. C. (*Coventry*); OLD READER.

SALE AND EXCHANGE.

Victor Cycle Co., Grimsby, sell Mail-cart Wheels and Parts. [4 R

Cycle Fittings, mail-cart wheels and shafts, mitre-cutting machines and cramps.—WALKER BROS., Wellington Road, Leeds. [3 R

Buyers of Gas or Steam Engines, Machinery, and Tools, should call at Britannia Co., 100, Houndsditch, London, or send 2d. for the Tool and Machinery Register, containing 4,000 lots wanted and for sale. Address—REGISTER, Britannia Co., Colchester. [8 R

Caplatzi's Matchless Technical Collections embrace most things electrical, optical, mechanical, chemical, photographic, models, materials. Catalogues, 2d.—Chenies Street, Bedford Square. [9 R

The Climax Screw-chasing Lathe Attachment for 3 to 6 in. foot lathes. Enables a novice to cut perfectly true threads of any pitch from 8 to 30 per inch; seen working. Price 57s. 6d.—DRESSER, Swan Cycle Works, Lewis Grove, Lewisham, S.E. [11 R

Fretwork Designs.—12 large Brackets, Photo Frames, Wheelbarrows, etc., 1s. 1d.; 40 small, 7d. Saws from 1½d. dozen, 1s. 2d. gross. Lists free.—TAYLOR'S Fretworkeries, Blackpool. [14 R

Lettering and Sign-Writing made Easy.—Also full-size diagrams for marking out eight alphabets, only 1s.—F. COULTHARD, Darlington Street, Bath. 100 Decorators' Stencils (60 large sheets), 2s. 6d.

100 Fretwork Designs (new), 100 Carving, 100 Repoussé, 30 Fret Brackets, 100 Sign Writer's Stencils (all full size), 300 Turning, 400 Small Stencils. Each packet, 1s.; postage free.—F. COULTHARD, Darlington Street, Bath.

The Leyton Saw Bench for hand power, with self-act feed, one man can cut 3 inches deep with ease. Prices and particulars post free upon application to LEWIS AND LEWIS, Wandsworth Bridge Wharf, Fulham, S.W.

The Model Typewriter, price 5s. Specimen of writing, one stamp.—WALTON, 9, Queen Anne Street, Stoke, Staffs.

Every Requisite for Scene Painting supplied.—CORBOULD'S Studio, 52, Commercial Rd., Peckham, S.E.